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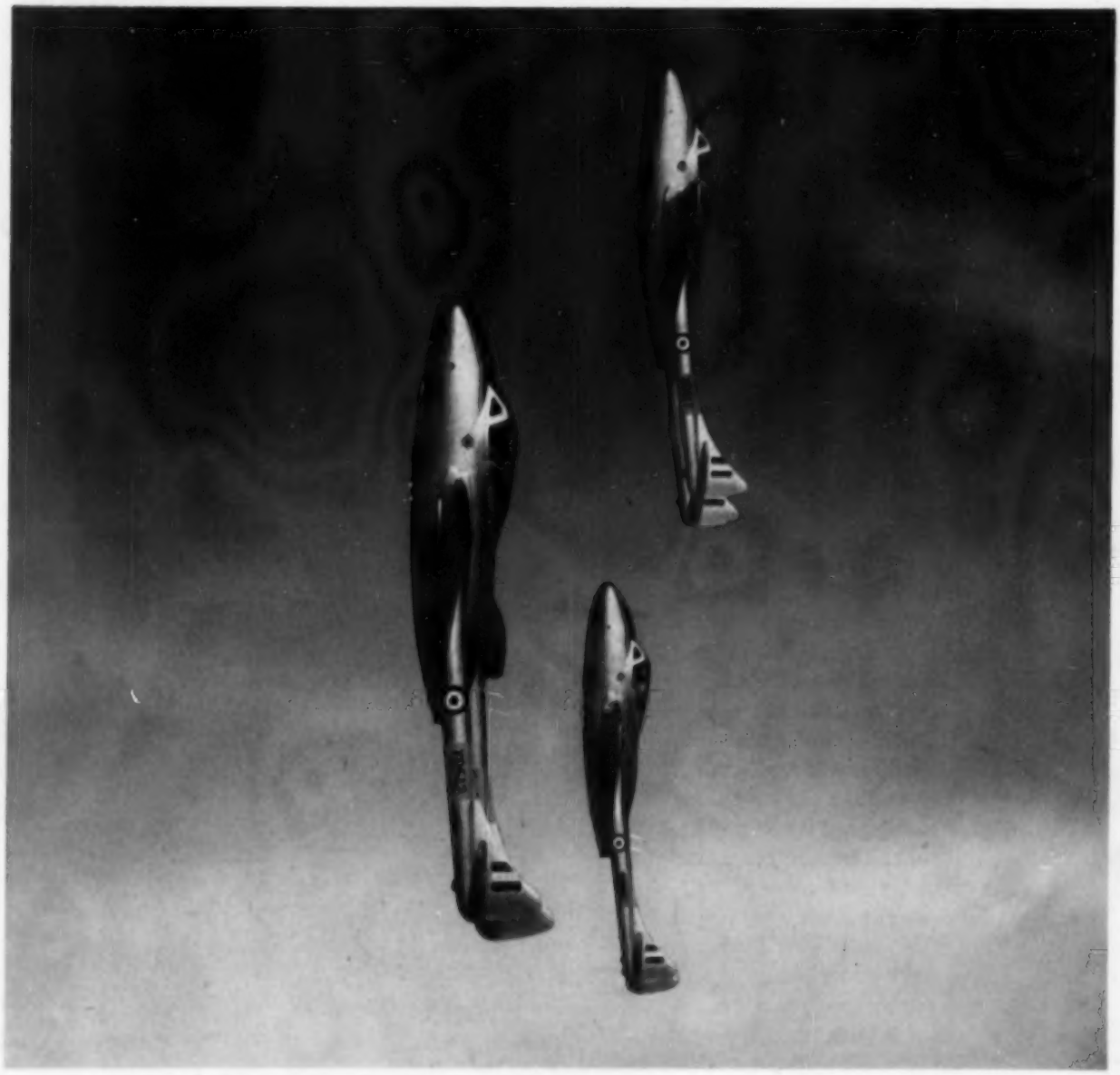

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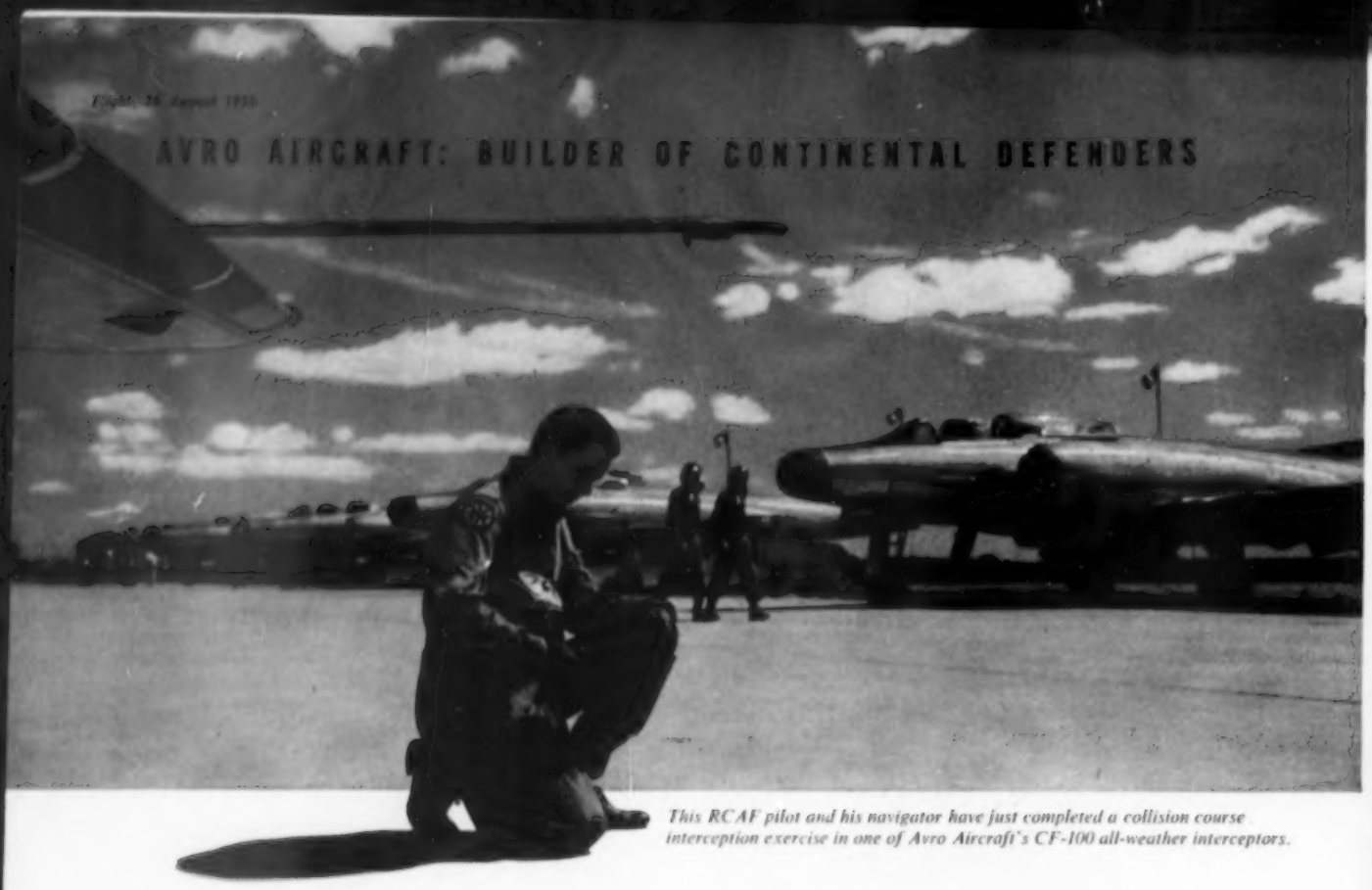

This RCAF pilot and his navigator have just completed a collision course interception exercise in one of Avro Aircraft's CF-100 all-weather interceptors.

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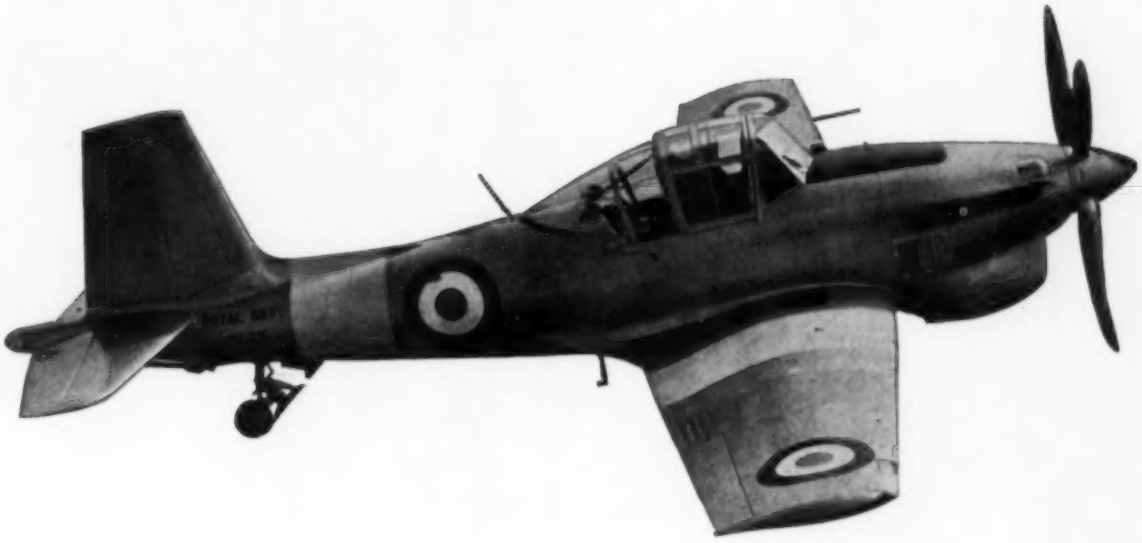

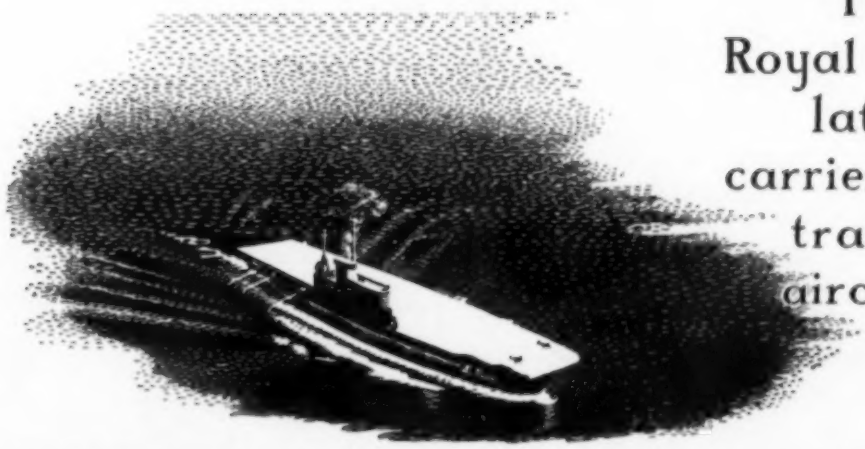

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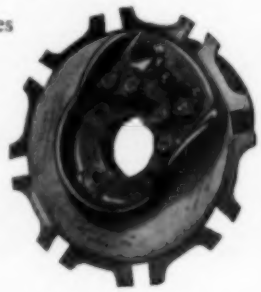

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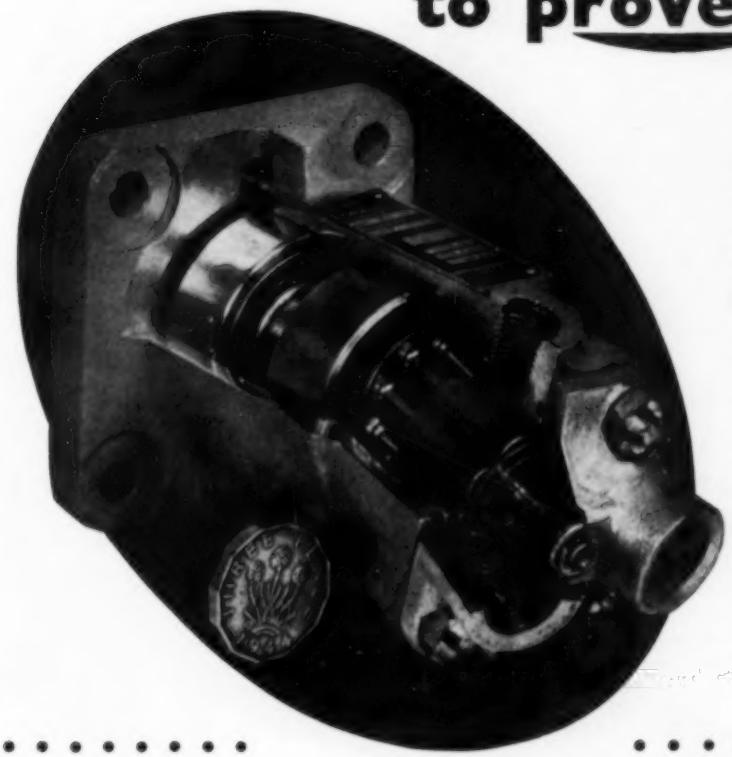

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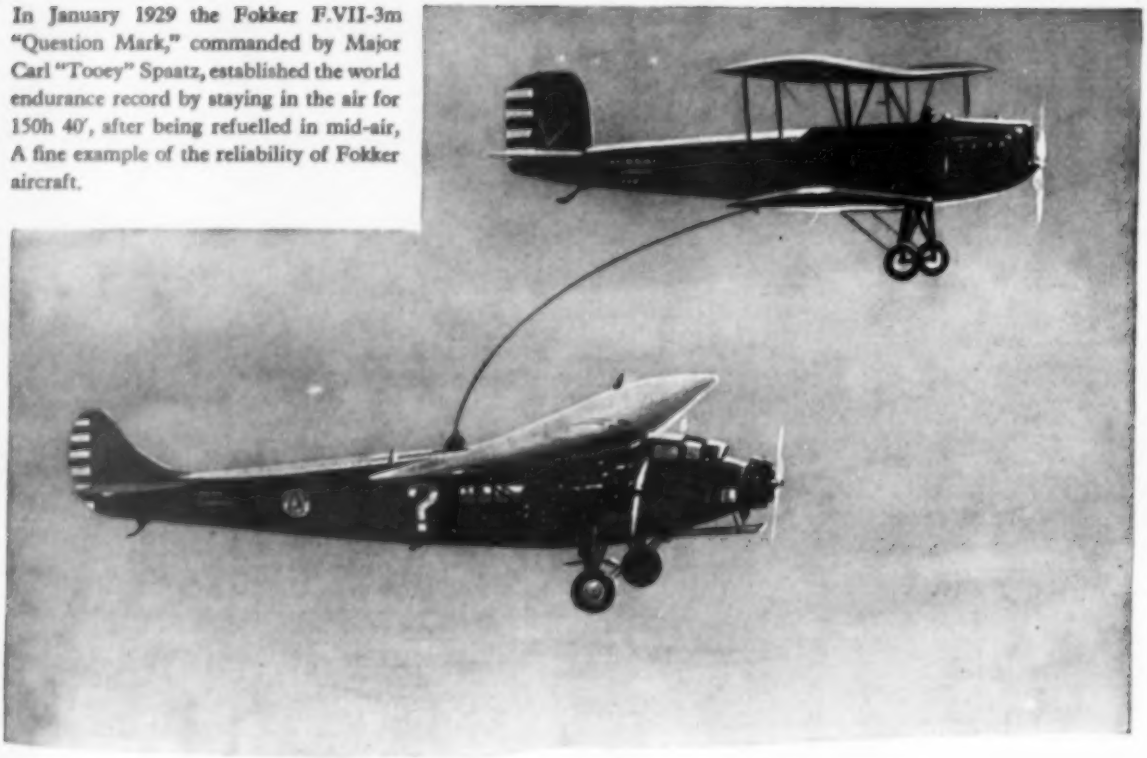

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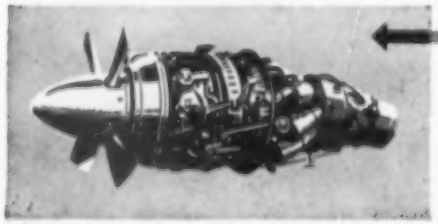

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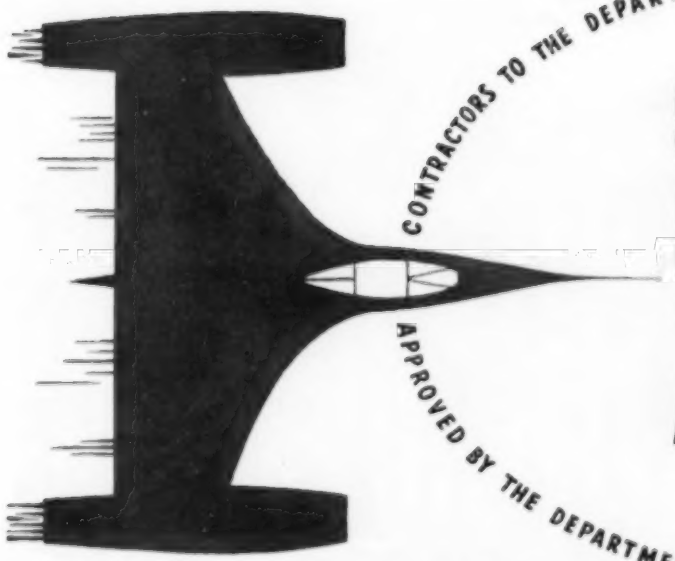

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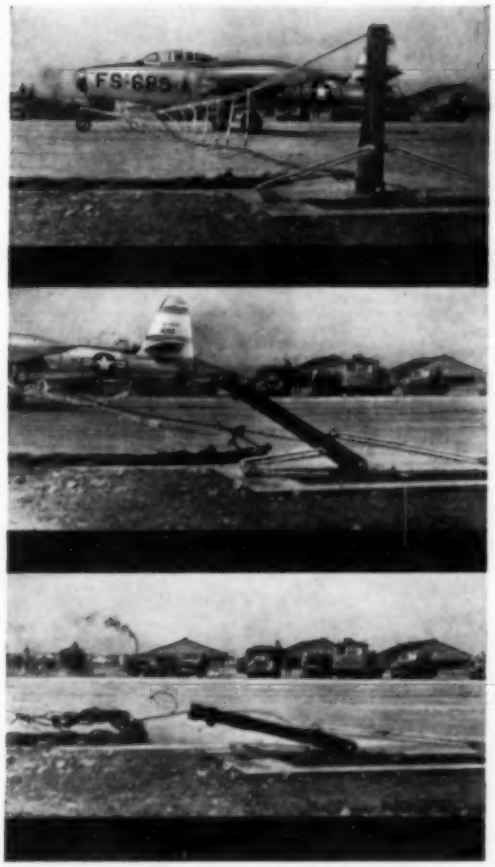

These sequence photographs show an F-84 jet fighter, simulating a brake-less landing at approximately 120 m.p.h. Top: plane approaches Runway Over-run Barrier consisting of nylon webbing and steel cable, affixed to twenty tons of steel chain, and attached to steel stanchions. Next: webbing is engaged, raising cable to landing gear height. Third photo: Landing struts pull cable taut, breaking it away from stanchions. Bottom: chain is pulling plane (out of photo) to smooth 200-foot stop.

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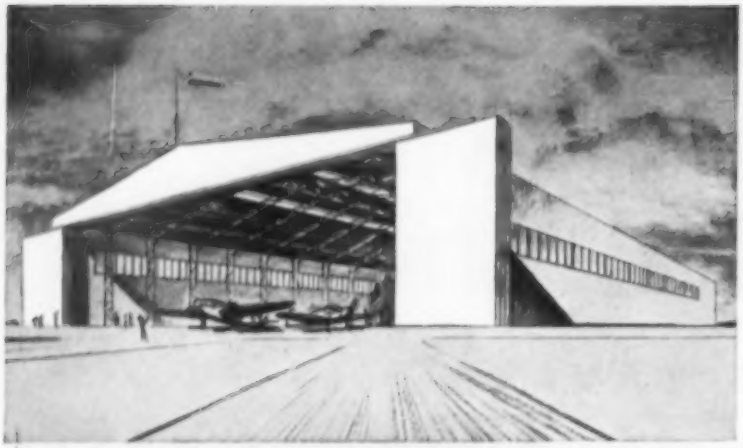

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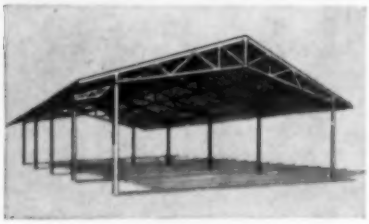

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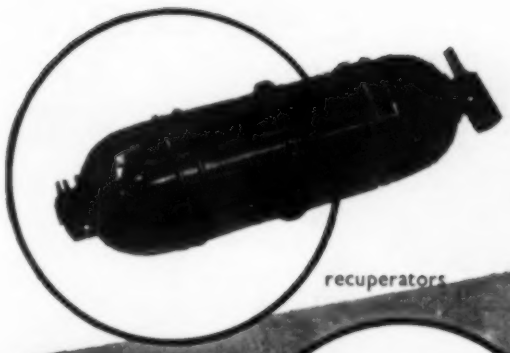

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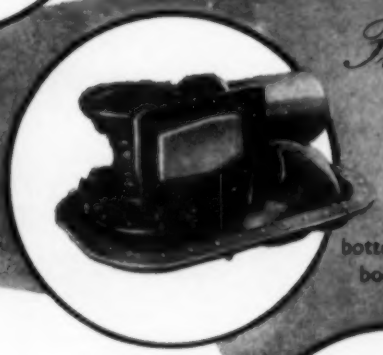

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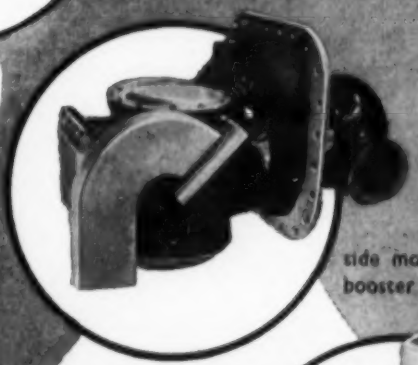

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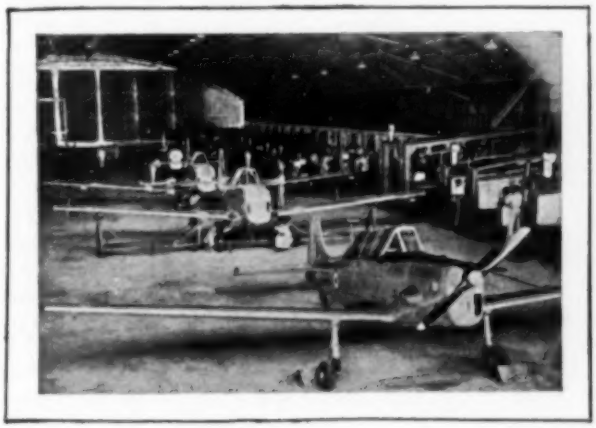

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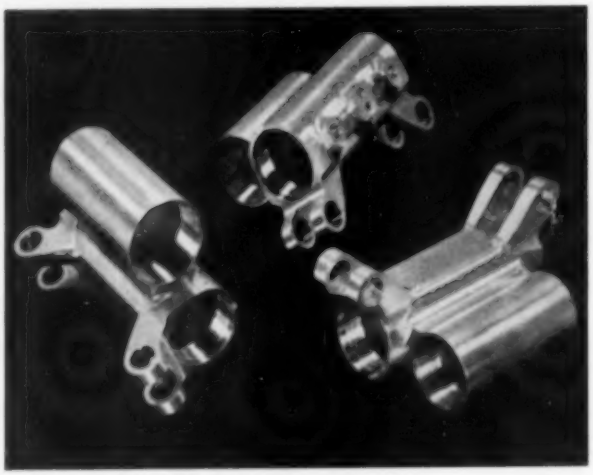

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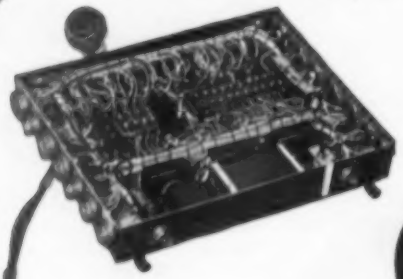

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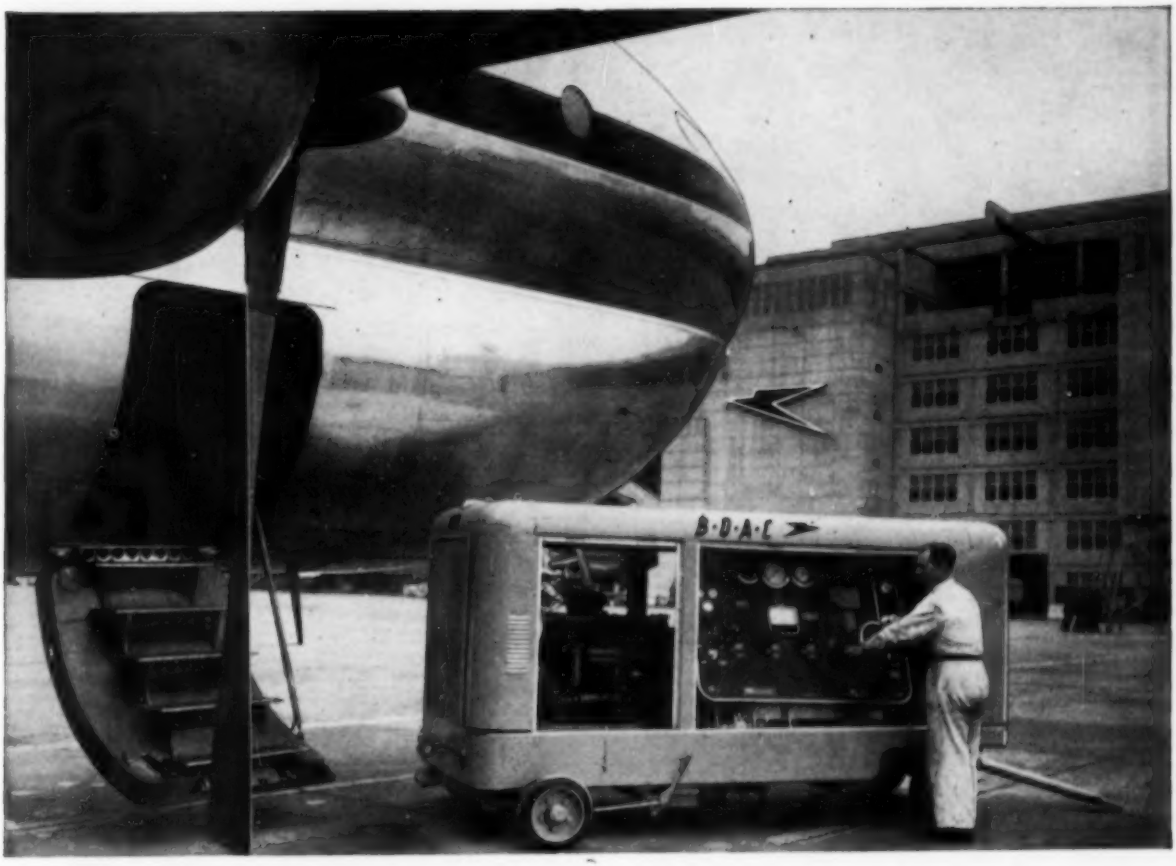

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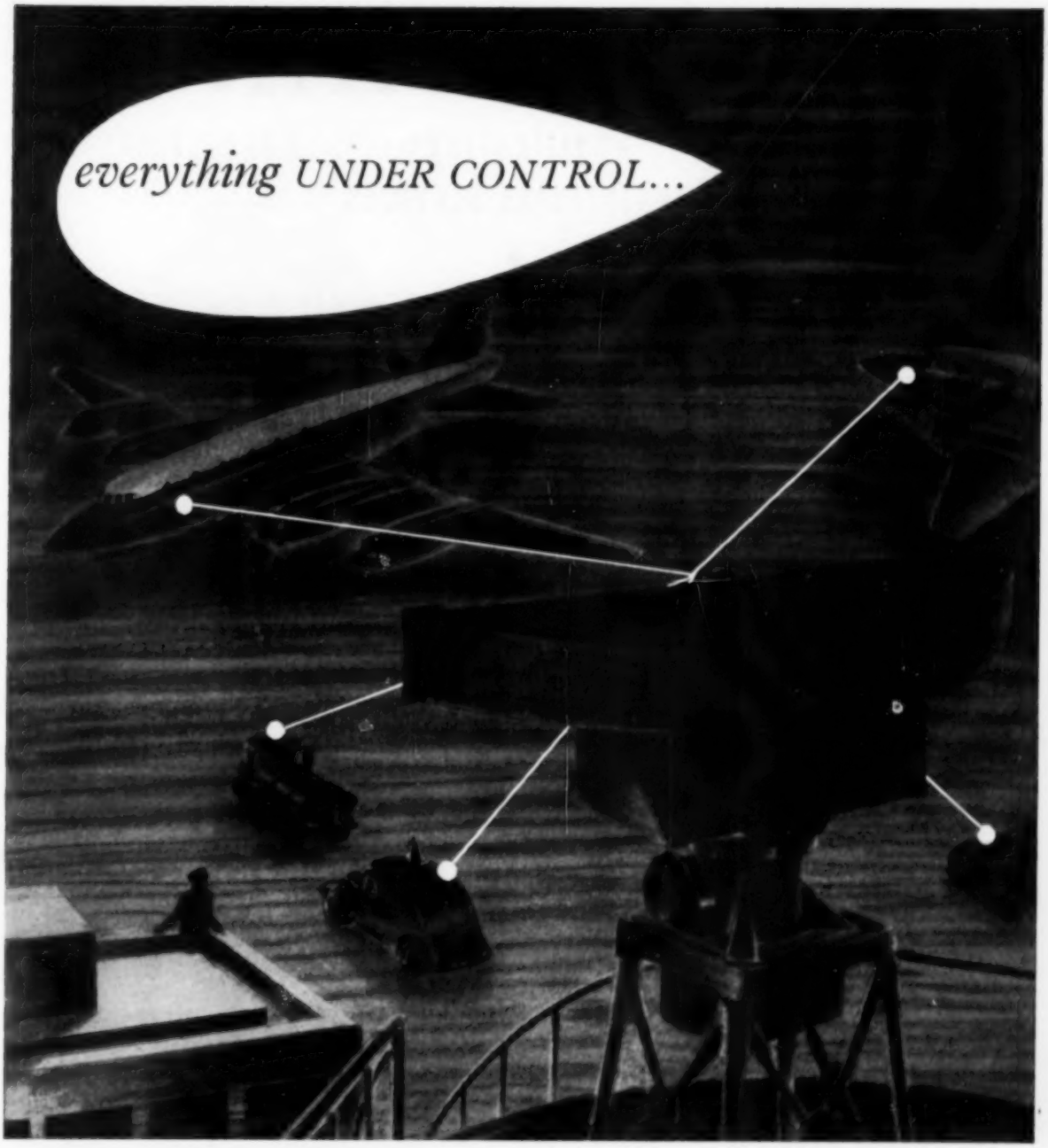

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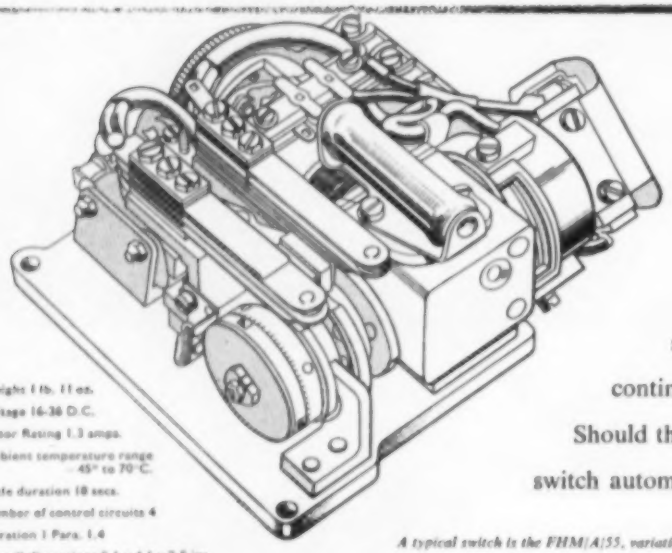

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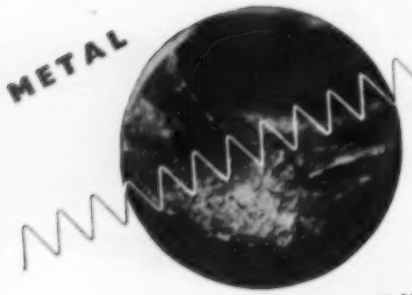

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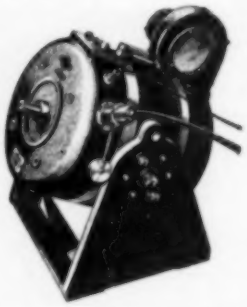

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Founded 1909

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A Commonwealth Year

DOG-LOVERS often calculate the age of their animals in relation to that of a human being by multiplying by seven. The working life of an aircraft might be related in the same way; but if a sense of proportion were to be retained its years of development would have to be divided by seven. One human year ago *Flight* published its first special number devoted to the aircraft industries of the Commonwealth countries; it was the first time such a review had been attempted. Today, a second "Commonwealth Special" is published in which is summarized the progress made during the past 12 months. No spectacular changes occur in so short a period, and much that we record now had been foreshadowed. Developments in aviation are paradoxically a slow, progressive matter, where seven years count for one of an earlier era.

In Canada, which is fortunate in having by far the largest and most active Commonwealth aircraft industry after that of the United Kingdom, many hopes and plans of last year have been realized; others are a stage nearer fruition. From the point of view of the public, there may not seem to be much visible change, but the main objective is being realized: military and civil aircraft are flowing from the production lines.

What of Australia? Here again, in another sizeable Commonwealth aircraft industry, plans have been fulfilled: Canberras and Avon-Sabres built in the Dominion are reaching the squadrons, to serve them for several years to come. Replacements for these aircraft are being carefully considered at this moment, for the issuing of new specifications and orders is already overdue.

Of the other Commonwealth nations, it may be said with assurance that all are actively air-minded and all expect to profit to an increasing extent from the services of aviation. They will continue to look to the United Kingdom for advice, guidance and equipment.

Variations on a Theme

UNTIL we watched the first British Lockheed International Aerobatic Competition at Coventry last week it had not occurred to us that aerobatic manœuvres in Great Britain have tended to become stereotyped. Yet when it is recalled that very nearly all British pilots of today learned to fly according to a more or less standardized syllabus of instruction introduced by the R.A.F. the fact is not, perhaps, surprising.

British pilots distinguished themselves at Coventry, excelling in those conventional aerobatic manœuvres which have long been accepted in the R.A.F. and Navy—the loop, slow roll, roll-off-the-top and stalled turn. Because flick and negative-g manœuvres have been taboo in the R.A.F. for a number of years, they have become the exception. Not so on the Continent, where bunts, outside loops and prolonged inverted flying are as much accepted manœuvres as they were in the inter-war Hendon displays. It is seldom that British piston engines are equippped for inverted flying; British light aircraft are not usually stressed for high negative-g loads, nor do they have the rather exaggerated control surfaces which are so helpful when making outside loops and related manœuvres.

Before another year passes and the Lockheed competition comes round again, it might be well to discuss and recall both standard and lost aerobatic manœuvres—and their names and definitions. In competition, should a roll-off-the-top be made so that the aircraft comes out on the level, or will a diving roll-off suffice? If the first strict interpretation applies, singularly few true rolls-off-the-top were seen at Coventry. Again, how much may a slow roll be barrelled? How vertically oval may a loop be before it is judged a poor one? And how much power may be used to pull you round a stall turn without it being unstalled?

The judges at Coventry had a most difficult task, and they performed it well. They had a vast variety of composite and complicated manœuvres to assess, widely differing styles and even more widely differing aircraft—ranging from the Meteor, which rolls as easily as it flies level, but calls for good judgment to loop, to elderly, under-powered biplanes in which a loop is "a piece of cake" but a good slow roll the work of a master. Yet perhaps it is the spectacle and appeal that matter, in which case too strict adherence to rules and definitions might complicate and spoil a most enjoyable competition.

HUNTER FOR TWO: The provisional name Hunter Two - seater conferred on this latest Hawker prototype (formerly referred to as the Hunter Trainer) is in keeping with a recent company statement that new tactical applications are foreseen. The aircraft has been flying from Dunsfold for several weeks.

FROM ALL QUARTERS

Canberra's Atlantic Shuttle

LAST Tuesday morning, August 23rd, an English Electric Canberra P.R.7, manned by Captain J. W. Hackett (pilot) and Peter Moneypenny (navigator)—both of Silver City Airways, Ltd.—left London Airport in an attempt to fly to New York and back to London in one day. The English Electric pilots were so fully occupied with work on the P.1 and the later marks of Canberra that none could be spared for the attempt.

The Canberra took off at 0710 hr B.S.T. and was to fly non-stop to Floyd Bennett Field, near New York. From there it was to refuel before returning. The total distance from London to New York and back is 6,920 statute miles—2,776 miles greater than that covered on August 23rd, 1952, when a Canberra set up two world records by flying from Belfast to Gander, Newfoundland, and back in one day.

Messages reaching London on Tuesday showed that the P.R.7 reached Floyd Bennett Field at 14.48 hr B.S.T., having made the crossing in 7 hr 38 min at an average speed of about 460 m.p.h. The turn-round was effected in 35 min and it was expected that, with a favourable wind, the return journey would be faster.

Avro's "New" 504

LAST autumn the Avro Company bought up a somewhat battered 504N at Old Warden, where it had been part of the Shuttleworth Collection. The decision was taken to convert it back to the 504K configuration, for that variant was the more historic, and under the supervision of the late Mr. A. Ainsworth and Mr. C. Broadhead, work went ahead at Woodford. It was necessary to rebuild the wings, ailerons and centre section; the front end of the fuselage had to be modified; and a completely new undercarriage and airscrew were required. A nation-wide "treasure hunt" ensued and the job was done.

True, another airworthy 504 was owned by the Royal Aeronautical Society; but this was not allowed to fly, and Avros had in mind demonstration flights on appropriate occasions.

Last Friday—August 19th—the transformed machine was ready. The pilot was Jimmy Orrell, and the passenger his colleague, Johnny Baker. Orrell, who was 504K-trained, made an initial flight of 29 minutes, during which he performed stalls, loops and a spin. Now the machine is to figure in a film about the life of Douglas Bader—another 504 trainee—before joining the Shuttleworth Trust Collection.

Credit for the rejuvenation must go jointly to Avro apprentices and to members of the industry, including Dunlop, Accles and Pollock and the Airscrew Company and Jicwood, Ltd. A unique contribution was made by Mr. Harold Rogerson, now of the Armstrong Siddeley Development Corporation, and one-time assistant chief designer at Avro. Guided only by an outline plan view of the airscrew, its pitch and diameter, he drew out in detail the required sections and general dimensions, and despatched them to Avros almost by return of post. This was work of a kind which he had first done when he designed the 504K airscrew to suit the Le Rhône engine 33 years ago.

TWO FOR A HUNTER: New portraits of Hawker test pilots Neville Duke and Frank Bullen, and an indication of the cockpit dimensions of the Hunter Two-seater, are afforded by this picture taken at Dunsfold.

The Conway Type-tested

AS we go to press, it is learned that a Rolls-Royce Conway by-pass turbojet has completed a British Government type-test, at a rating of 13,000 lb. A Rolls-Royce statement remarks that the relatively low jet velocity in conjunction with the latest form of jet-nozzle will aid in reducing noise. The Conway has the lowest specific fuel consumption of any type-tested jet engine.

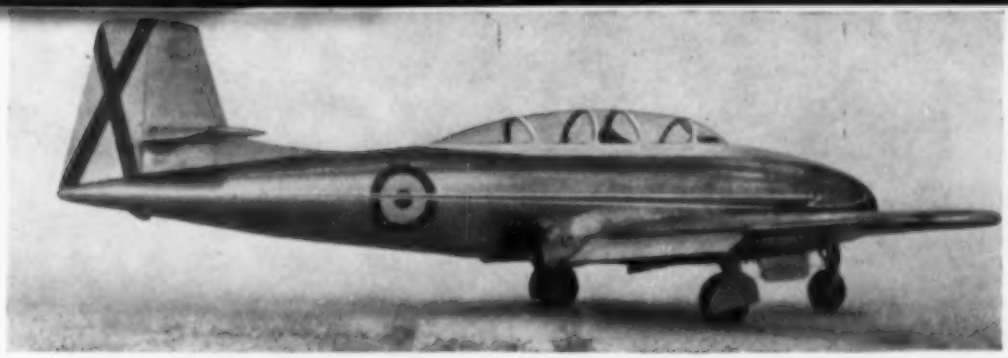
Nimonic 100

MENTION may now be made of a new alloy in the world-famous Nimonic series. Known as Nimonic 100, the new alloy represents a most important step forward in making available to engine manufacturers material with still further improved creep-strength properties at elevated temperatures. Nimonic 100 has very high resistance to creep yet may be used at temperatures roughly 30 deg C higher than those permissible with previous alloys in the series. Stress-to-rupture properties are given below, and we are informed that these may safely be taken as a basis for design calculations.

It may be emphasized that, with each new alloy, the operating temperature at which the material must be tough and stiff approaches more closely the temperature at which it can be worked during manufacture. That production problems of Nimonic 100 have been solved is clear from the announcement that quantities of the new alloy have now been supplied to several engine manufacturers for complete evaluation in actual gas turbines. The new alloy was developed in the research laboratories of the Mond Nickel Co., Ltd., and is manufactured by Henry Wiggin and Co., Ltd.

STRESS-TO-RUPTURE PROPERTIES OF NIMONIC 100

Temperature deg C.	Stress (tons/sq in) for rupture in		
	50 hours	100 hours	300 hours
870	13.5	12.0	9.5
925	8.5	7.0	5.5
940	6.7	6.0	4.5
980	4.0	3.5	3.0



***ME SAETA:** The name Saeta (arrow) has been conferred on this new Spanish trainer, designed by Willy Messerschmitt, and referred to in a news item on page 280.*

"FLIGHT" NEXT WEEK

THE next issue of *Flight*, dated Friday, September 2nd, will be the annual Britain's Aircraft Industry Number, and it will be the largest issue of this journal ever published. All current British aircraft and engines will be reviewed and illustrated, and new equipment described. There will, in addition, be a new form of directory to the industry, making the whole publication a particularly valuable work of reference. A guide to the S.B.A.C. Show will be included. Price of this issue will be 2s. 6d.; demand is heavy, and orders should be placed in advance.

The two succeeding numbers will be the Farnborough Report (September 9th) and Farnborough Review (September 16th).

Supersonic Escape

DETAILS of an improved method of emergency escape from supersonic aircraft have been disclosed by the U.S.A.F. The system is being employed only in research machines, and the principal element is a downward-ejection seat, stabilized in an upright position by two fins. Should the pilot have to abandon his aircraft at a great height, he "rides" the seat down quickly to 15,000ft, where separation occurs automatically and the pilot continues by means of a conventional parachute. Should a low-altitude bale-out become necessary, the pilot and his parachute are cleared from the seat within three seconds.

The Douglas Aircraft Company, who are responsible for the seat in co-operation with the U.S.A.F. Research and Development Command, state that the scheme was evolved for the X-3 for two reasons. First, the force required to shoot the ejection seat up and over the tail at high speeds was "beyond human endurance"; secondly, an upward-opening canopy would have created a serious drag resistance. The problem of seat stabilization was complicated by the need for stability through the turbulence of the supersonic, transonic and subsonic regimes. The finned seat was tested on the high-speed track at Edwards A.F.B. and in wind tunnels at the Wright Air Development Centre, and it was repeatedly ejected from the bomb bay of a machine travelling at high speed and great height. The fins maintained the seat in a safe position (i.e., with the body upright in relation to the direction of force) until it had reached a low enough speed and height for separation. The Douglas announcement continues:—

"Peak force from wind drag was reduced by increasing the weight of the seat substantially by installing on it such equipment as the ejection rails, the airplane's complete oxygen system and various other components normally attached to the airframe. Douglas engineers said transferring weight to the seat resulted in a net weight saving to the airplane.

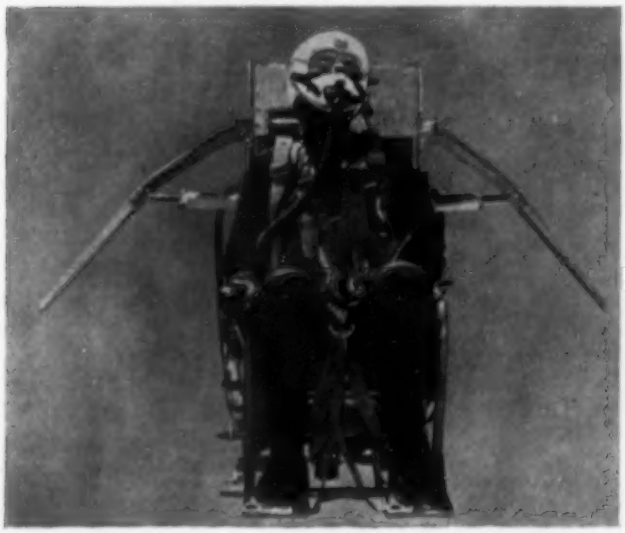
"Other high-speed tests revealed that air ramming into the front of a standard helmet built up pressures which would blow it from the pilot's head, leaving him without protection from wind blasts and without oxygen, since the oxygen mask is attached to the helmet.

"Douglas engineers partially solved these problems by incorporating into a conventional helmet a protective visor and reinforcing guard for the oxygen mask. Since it was impracticable to seal the headgear completely against supersonic ram pressures, air ducts were sculptured into the helmet to provide escape paths for inside air pressures and create a partial vacuum to help hold the helmet in place.

"The standard g suit was modified by stitching a reinforcing nylon vest to the suit and re-locating the zipper from the chest to the back. A nylon collar was added to connect the helmet and suit and protect the pilot's neck.

"Building the oxygen supply into the ejection seat system eliminated need for a bale-out bottle, since the escaping pilot can use the airplane's regular oxygen output until he has reached a point in his descent safe enough for normal breathing. A special oxygen quick disconnect fitting, using permanent magnets to assure a firm seal, was devised . . ."

***BUTTERFLY BOMB:** The deliberately weighted downward-ejecting seat developed for the Douglas X-3 and described on this page has, with its fins, the aspect of a wartime menace of unpleasant memory.*



Coventry Results

THE final meeting in this year's National Air Races series, held at Coventry on Saturday, decided the destination of the 1955 British Air Racing Championship, placings in which are given below, together with those in the King's Cup Race. Also tabulated are the results of the Lockheed Trophy Aerobatic Competition. The meeting is reported on pages 285-287.

BRITISH AIR RACING CHAMPIONSHIP AND KING'S CUP RACE

B.A.R.C. Pts.	Pilot	Aircraft No.	King's Cup		
			Place	Speed	H'cap
71	J. N. Somers	85	10	172	15.19
67	J. H. Denyer	23	11	108.5	01.24
61	T. G. Knox	69	5	146.5	10.54
58	B. Meile	21	13	106.5	00.51
58	C. Gregory	5	7	115	03.15
58	D. Westaby	9	9	124	05.54
53	P. S. Clifford	97	1	213.5	19.20
52	R. R. Paine	96	6	187	17.04
52	P. Blamire	80	14	140.5	10.29
50	G. Marler	92	4	169	14.32
48	D. F. Ogilvy	41	non-finisher		00.04
48	J. R. Johnston	43	3	140	09.29
45	P. Vanneck	22	2	106	00.00
40	A. Barker	68	12	141.5	10.49
39	J. M. Donald	24	8	109	01.24

LOCKHEED AEROBATIC COMPETITION

Nationality	Pilot	Aircraft	Engine	Registration	Prize
French	Leon Biancotto	Stampe S.V.4A	Renault 4POS 140 h.p.	F-BCFA	£500 and Lockheed Trophy
French	Alain Hisler	Sipa 200 Minijet	Turboméca Palas 350 h.p.	F-BGVN	2nd (£300)
French	François d'Huc-Dressler	Stampe S.V.4A	Renault 4POS 140 h.p.	F-BCFA	3rd (£200)
British	Ronald L. Porteous	Auster J5L Aiglet	Gipsy Major 10 145 h.p.	G-ANXC	4th (£100)

Note: F. C. Fisher, Tiger Moth, received £100 for the best performance in an aircraft weighing less than 1,000 kg. flown by a British pilot and not in the first four places.

British TACAN

IT is well known that, despite initial opposition by the C.A.A. and some commercial airlines, TACAN (Tactical Air Navigation System) is being slowly introduced as a standard navigational aid in the United States. It has now been announced that British versions of both the airborne and ground equipment used by this system are being developed under M.o.S. contract by Standard Telephones and Cables, Ltd. It is known that TACAN can be miniaturized for even the smallest military aircraft.

Operating within the frequency range 962-1,214 Mc/s, TACAN

HIGH FLYERS AGAIN: Converted Mosquito B-35s of an order of ten plus one for Sparton Air Services of Ottawa. They are to be used for high-altitude photography. Conversion is by Derby Aviation, Ltd., who prepare the machines for flight at the M.U., take them to Derby, completely overhaul them and then deliver by air to Prestwick. From here, they are air-ferried to Canada and on arrival receive Canadian Cs. of A. David Ogilvy test-flies these machines from Derby Airport, Burnaston; in the picture he is seen (right) with Ron Paine, D.A.'s technical director.

FROM ALL QUARTERS . . .

is an exceedingly complex aid comprising a ground beacon transponder and an airborne interrogator/receiver with an indicator which provides the pilot with bearing and slant distance from the fixed ground station. The normal maximum range is in the region of 200 n.m., and up to 100 aircraft can be handled by each ground station at a time. British and American airborne equipment are physically and electrically interchangeable. The Standard Telephones units are now in an advanced state of development and are undergoing trials. We intend to make further reference to this system in an early issue. Both ground and airborne units will be displayed by S.T.C. at the forthcoming S.B.A.C. Exhibition.

R-R./N.A. Rocket Agreement

A "MUTUAL technical-assistance agreement" has been reached by North American Aviation Incorporated, of Los Angeles and Rolls-Royce, Ltd., whereby Rolls-Royce will be licensed to manufacture rocket-propulsion systems designed and developed by North American. Both companies will exchange technical information "relating to engineering development and manufacturing in these fields." The agreement, which covers a ten-year period, was entered into between the companies with the approval of the British and U.S. Governments. The U.S. Assistant Secretary of the Air Force, Mr. Trevor Gardner, has stated that the programme is in support of the Wilson/Sandys collaboration agreement on guided missiles between the United Kingdom and the United States, dated June 12th, 1954.

It is known that North American have been engaged in the development of rockets delivering extremely high thrusts.

Avro Senior Aerodynamicist

WHEN a few weeks ago, Mr. J. R. Ewans was made chief designer to A. V. Roe and Co., Ltd., the post of chief aerodynamicist became vacant. Last week the company announced that Mr. P. L. Sutcliffe, B.Sc., had been appointed to fill it. Educated at Heath School, Halifax, and London University, Mr. Sutcliffe has since 1945 made his career in aerodynamics successively with Bristol, Miles and Boulton Paul. He was senior aerodynamicist of the last-named company when he left in 1951 to go to A. V. Roe, where he was appointed assistant chief aerodynamicist last year. Mr. Sutcliffe is 30 years of age, married, and has two children.

Mr. P. L. Sutcliffe.

Messerschmitt's Spanish Jet

A REPORT from Madrid says that the Spanish Air Minister, Lt-Gen. Gonzalez Gallarza, accompanied by Air Ministry officials and senior Air Force officers, watched a demonstration of the new Spanish-built jet aircraft, the Saeta H200-R, at Seville airport on 16th August.

The aircraft was built at the Hispano Aviacion works in Seville by Spanish engineers and technicians under the guidance of Prof. Messerschmitt. It was piloted by Maj. Valiente, who was one of the first Spanish pilots to attend a flying course in a U.S.A.F. base in West Germany.

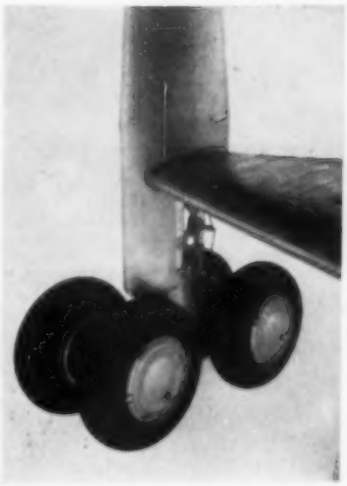
M.o.S. Appointments

THE Ministry of Supply announces three senior appointments on its aircraft and guided-weapons side. Mr. J. E. P. Dunning, who has been assistant director, Eng.R.D.6, since 1950, is promoted to deputy chief scientific officer and appointed Director of Engine Research and Development II; he is 42 years of age. Mr. R. O. Freeman, 57, Assistant Director of Guided Weapons Production for the past three years, is made a deputy chief scientific officer and appointed to the post of Director of Guided

FASTEST IN SERVICE?: With the possible exception of Russia's new single-seat day fighter the North American F-100 Super Sabre, as seen here in service with the U.S.A.F. over rugged country, is the fastest aircraft at present operating with any air force. The engine is a Pratt and Whitney 157, with reheat; armament, four 20 mm guns.

BEVERLEY OUTLOOK

These crew's-eye views were taken during the journey of Blackburn Beverley XB 262—seen above during a refuelling stop at Marignane, in Southern France—from Boscombe Down to Idris, North Africa, for M.o.S. tropical trials. In the view immediately above are the two starboard Centaurus 173s as seen by the 2nd pilot; in the next photograph is the tail unit as seen through the astrodome. The two pictures on the right show (left) a main leg as it looks when not under load, with the fairing (which opens forward under compression) neatly closed up against the leg; and (right) a glimpse of desert, during a steepish turn, through the rear of the hold (the Beverley is flying with doors removed).



Weapons Production. Thirdly, Mr. R. J. Lees (37), Superintendent of Experimental Physics at the Radar Research Establishment since 1953, is promoted to deputy chief scientific officer and becomes Director of Scientific Research, Guided Weapons.

"Gas Turbines"—A New Edition

SO steadily does the gas turbine continue to advance in design, materials, performance and application that any book purporting to deal with the subject of jet propulsion as a whole must be constantly revised if it is to continue to present a true picture. That is the case with *Gas Turbines and Jet Propulsion*, a new edition* of which is announced today.

Since the death of the original author, G. Geoffrey Smith, in 1951, the work of revision has been assumed by his associate F. C. Sheffield, with assistance from W. T. Gunston, Technical Editor of *Flight*. They have brought the text and illustrations of this standard work up to date and have again enlarged it. A foreword has been contributed by Sir Harold Roxbee Cox, a former director of the National Gas Turbine Establishment.

Among the sections which have been very considerably enlarged is that dealing with combustion equipment, while the steadily increasing application of gas turbines in industry, and for transport applications is reviewed in detail.

Those who are not familiar with the previous edition can obtain some idea of the wide scope of the work from the following list of section headings:—

Abbreviations; Equivalents; Propulsion by Jet Reaction; Early Projects; Thrust and Performance; Jets or Airscrews; Gas Turbine Components; Combustion and Fuels; Fuel Systems; Metallurgical Problems; Research, Testing and Maintenance; British and Canadian Gas Turbines; American Gas Turbines; European Gas Turbines; Compounded Units; Ramjets, Pulsejets and Rockets; Rotating-wing Propulsion; Turbines for Road Vehicles; Other Turbine Applications; Appendix; Early British Developments. Index.

"Gas Turbines and Jet Propulsion," sixth edition. Size 8½in × 5½in. 412 pages. Price 35s (by post, 35s 8d). Published for "Flight" by Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1.

Napier Appointment

THE appointment of G/C. B. H. Becker, A.F.R.Ae.S., R.A.F. (ret.), as technical manager, turbo-propellers, is announced by D. Napier and Son, Ltd. He will be responsible to Mr. A. J. Penn, chief engineer of the company's gas turbine division.

G/C. Becker, who is 43 years of age, joined the Royal Air Force in 1928 and retired this year after 27 years' service. During four of his early years in the Service he served as a pilot in army co-operation squadrons at home and in India. In 1937 he studied engineering at the R.A.F. School of Engineering, Henlow, and has been employed on engineering duties in the R.A.F. ever since. These duties included five years' secondment to the Ministry of Aircraft Production during the war.

In 1946, on the re-opening of the Royal Air Force College, Cranwell, G/C. Becker was appointed chief engineering instructor. From 1949 to 1951 he was employed on technical staff duties in the Far East, and after 18 months in the Air Ministry he was appointed to be S.A.S.O. at H.Q. 43 Group. In 1954, and until the time of his retirement, he was serving in the department of the Air Member for Personnel at the Air Ministry.

G/C. Becker will meet a number of old friends at Napiers, for he was stationed at their works when he was with M.A.P. during the war.

HERE AND THERE

The American Floods

ONCE again the helicopter has proved its value in emergency. Over 900 lives were reported to have been saved last week by Service and civil rotorplanes assisting with the rescue work in the disastrous floods in north-eastern U.S.A.

Absinthe Friend?

FROM *The Sunday Times* report of the King's Cup Race: "The Mew Gull, found in a bar in France, where it had been dismantled during the German occupation. . . ."

Italics Ours

AND from the official programme of the Coventry Air Pageant: "For the first time the science or sport of *aeronautics* has received official recognition from the Royal Aero Club. . . ."

Air India to Australia

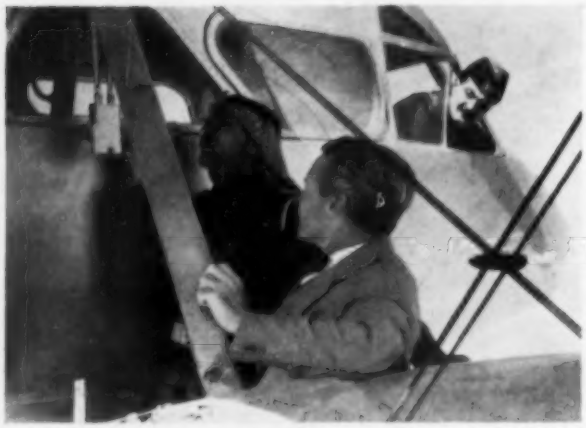
A DIRECT service between India and Australia is to be inaugurated by Air India International next year. This was announced in Sydney by an official of the airline, Mr. V. G. Gadgil, who added that the service would probably be once a week at first, but would become more frequent.

More Silver Stars

SINCE our description of current production at Canadair (page 302) went to press, an additional order from the Canadian Department of Defense Production for further T-33 Silver Stars has been announced by J. G. Notman, president of the company. The number involved was not stated.

Air Minister's Graduation

AT 46 years of age, the Air Minister, Lord De L'Isle and Dudley, has learned to fly; last week he went solo after a total of 9½ hours' instruction. During the Parliamentary recess he has been taking almost daily instruction at Bembridge Airport in the Isle of Wight, flying in an R.A.F. Chipmunk; his instructor has been F/L. F. W. Rickard, of London University Air Squadron.



MIDDLE-EAST WEATHER: Pilot, observer and meteorological expert—named in the paragraph below—with one of the Rapides of the Arab Legion Air Force.

A.L.A.F. Met.

FOR about a year, the Arab Legion Air Force has been undertaking daily met. reconnaissance flights, using one of the small number of Rapides which, with Doves and a few other aircraft, comprise its strength. Daily vertical soundings to 650 mb (approximately 11,500ft) are made, recording temperatures and humidities as well as visual observations of the clouds, visibility, icing, and other phenomena. In the photograph above, the pilot is Lt. Ziad Hamzeh, and the observer is Cpl. Saleh Yusef. With them is Jacques Cocheme, who is the United Nations Technical Assistance meteorology expert in the Hashemite Kingdom of Jordan.

Ryan V.T.O.

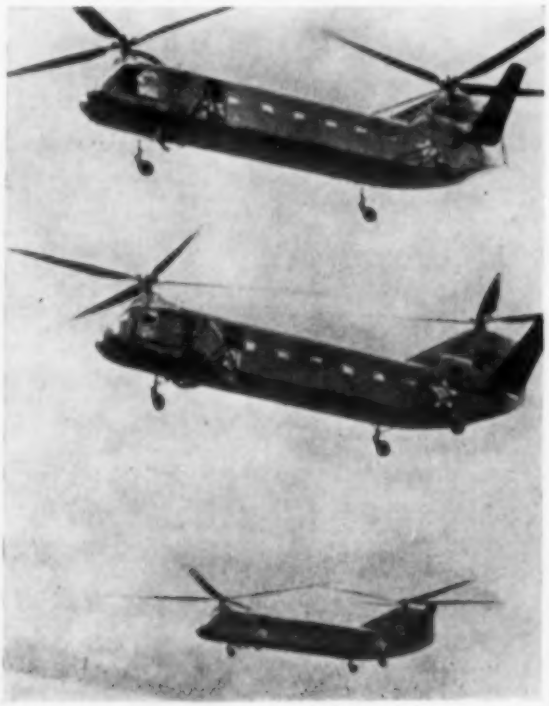
EARLIER this week it was announced in Los Angeles that flight tests of the Ryan XF-109 were imminent at Edwards A.F.B. The XF-109, which is powered by an advanced model of Rolls-Royce Avon, is the first jet-powered vertical-rising fighter prototype. No details of the aircraft have yet been released, but the machine was taken to Edwards by lorry from the makers' plant at San Diego and, although heavily shrouded, it appeared to have a delta wing.

FOR S.B.A.C. SHOW VISITORS

NEXT week we shall publish a detailed guide for Farnborough Show visitors. Meanwhile, the following condensed information will be found useful. *Dates:* Monday, September 5th, aircraft industry technicians' day; 6-8th, trade days; Friday, 9th, public premiere; Saturday and Sunday, 10th and 11th, public days. *Prices:* Friday—£1, children (under 14) 10s., cars £1 (plus fees for occupants). Saturday or Sunday—5s, children 2s 6d, cars £1 10s including six occupants (excess passengers at normal fees), motor cycle parking 2s 6d. Motor-coaches will be parked on the Friday at £1 and on the Saturday or Sunday at 10s. Tickets for the Friday only may be obtained in advance through Auto-Parks, Ltd., 1-31 Maclise Road, London, W.14.

DARK DOBBINS: "Horse" is the Allied code-name for this type of Soviet twin-engined assault-and-transport helicopter.

JUKE BOXES—British made—till G-AMGX, a Marathon "flying showroom" now being prepared for a tour of North America.



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Herald

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Rugged and adaptable, the Herald will have an excellent performance in tropical conditions. Its four engines and pressurised cabin will ensure dependable and pleasant travel in regions where larger aircraft cannot operate.

Heralds can make quick turn-rounds on out-of-the-way airstrips. The high wing, conducive to a cool cabin, also enables freight to be loaded or removed simply when only the crudest ground equipment is to hand. As well, Heralds are easily maintained in the field.

HANDLEY PAGE

RADLETT · LONDON · READING

Desoutter's famous 4-year old

Since he first galloped out of the celebrated Desoutter Stables 4 years ago, this celebrated gee-gee (known as G.2) has never stopped winning. 'Beats all comers on all kinds of going' said our notorious Managing Director, celebrating yet another famous victory. 'He's got a little something that the others haven't got.' The Jockey Club is investigating.

If *you* investigate G.2 you'll find the 'little something' is a two-speed gearbox. At the turn of a switch it gives him over 1,000 r.p.m. for light work and 500 r.p.m. for heavy going through steel with a $\frac{1}{2}$" or $\frac{5}{8}$" bit between his teeth. The G.2 two-speed drill is just one of our ELECTRIC power tools — there are many other types, speeds and sizes in The Desoutter string.

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All Desoutter power tools are obtainable only direct from us. We'll be glad to give you further details, arrange a trial canter, or lend you one for nothing!

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CBC 217

CIVIL AVIATION

B.E.A.'s BEST YEAR

THE full story of B.E.A.'s twelve-month transformation—from an airline losing at a rate of £1¼m annually to one operating at a small but definite profit—is told in the Corporation's report, published this week, for the financial year ended March 31st, 1955. Highlights of the report, including the more significant financial and operating statistics, are summarized below.

As the table of statistics shows, the major achievement of the year was a 16 per cent increase in operating revenue against an increase of only 3.8 per cent in expenditure. It would undoubtedly be wrong to suppose that any one branch of the airline was entirely responsible for this improvement, though it seems probable that the Viscount was the greatest single contributing factor. Figures given for Viscount operations during 1954-55 are thus of particular interest.

The average strength of the Viscount fleet operated during this period was 21.1 aircraft, which operated at a mean load factor of 67.2 per cent and earned 38 per cent of B.E.A.'s income. Viscount traffic totalled 346,174 passengers and 4,188 tons of freight and mail, carried on 13,922 flights of an average distance of 484 miles. This is rather less than the optimum stage-length for the Viscount, which may account for the break-even load factor (total costs) of 59.6 per cent—a value which seems a little higher than might have been expected. Even so, Viscounts earned an average of £23.8 profit for each of 29,997 revenue hours flown.

By comparison with the figures for 1953-54, Viscount utilisation increased last year by 18.3 per cent—the average being 1,724 hours per aircraft a year. This clearly does not represent the optimum utilization obtainable with the Viscount on B.E.A.'s network, since the average total for Elizabethans, which are operated on shorter stages, was 2,009 hours.

The Elizabethan's contribution to B.E.A.'s most successful year, incidentally, was only slightly less than that of the Viscount—as shown by the fact that Elizabethans earned 34 per cent of total revenue and carried 610,211 passengers.

Due to the use of larger aircraft it was possible for B.E.A. to increase greatly their ton-mile capacity without a corresponding increase in size of fleet or number of hours flown. There was, in fact, a slight drop in revenue hours flown—from 168,445 in 1953-54 to 155,170 last year. As a result, crew utilization decreased (captains, for example, averaged 548 hours compared with 629 hours in 1953-54); this situation should be improved, however, by the secondment of 19 pilots to four airlines abroad—Lufthansa, Iraqi Airways, T.A.A. and B.W.I.A.

There were significant increases in traffic on both international and domestic networks. On the international services, which carried more than one million passengers for the first time, traffic increased by 24 per cent, compared with an average of 14 per cent for other airlines operating services between the United Kingdom and Europe. On domestic routes, traffic was up by 16.6 per cent, the most impressive increase being on the London - Manchester route, which carried nearly 50 per cent more passengers.

An encouraging development was the reduced differential between summer "peaks" and winter "troughs" of traffic, which have always been among B.E.A.'s greatest problems. Traffic increased by 22 per cent during the six winter months of 1954-55.

Passenger traffic accounted for 82.9 per cent of B.E.A.'s gross revenue—a higher proportion than ever before. Freight development, the report admits, was disappointingly slow; it is hoped, however, to increase revenue from this source.

Looking ahead, the report states that the Corporation is well advanced with plans for a much faster, larger and more economic successor to the Viscount, and is considering replacements for the DC-3. At present, however, it sees "no sign of a satisfactory large helicopter nearing the commercial stage." It notes that representations have once again been made for the installation of Fido at London Airport and expresses the hope that work on Gatwick—essential for B.E.A.'s continued development from 1958—will be pressed forward energetically.

	1954-55	1953-54	Percentage Variation
Net profit or loss	+£63,039	—£1,773,797	
Traffic revenue	£16,594,461	£14,256,091	+16.4
Operating revenue	£17,141,314	£14,773,170	+16
Expenditure	£16,589,000	£15,975,721	+3.8
Capacity ton-miles offered ...	98,330,733	83,593,253	+17.6
Load ton-miles sold	63,646,902	53,594,689	+18.8
Revenue load factor	64.7%	64.1%	
Passengers carried	1,874,316	1,656,779	+13.1
Passenger load factor	68.4%	66.3%	
Passenger-miles flown	577,077,730	480,065,449	+20
Mail carried (tons)	6,964	6,582	+5.8
Freight carried (tons)	14,884	14,559	+2.2
Average No. of staff	9,112	8,993	+1.3

EARNING THEIR KEEP

FIGURES showing the utilization of the first four Australian Viscounts during their initial six months of operation have reached us from T.A.A. Even better results are likely from the fifth aircraft (VH-TVF, illustrated on page 321 of this issue), which is due to complete six months of service on October 1st. Utilizations of the first four are as follows:

Aircraft	VH-TVB	VH-TVC	VH-TVD	VH-TVE
Completed 6 months on	24.5.55	7.6.55	16.6.55	10.7.55
Hours flown	1,216	1,282	1,263	1,475
Equiv. block hours ...	1,338	1,410	1,389	1,580

These results are better than any previously attained by T.A.A. aircraft during their initial period of service. The Rolls-Royce Dart turboprops have contributed their full share towards the Viscount's success in Australia: at August 8th, T.A.A. had completed 32,300 Dart hours with only one non-scheduled removal. This "very remarkable demonstration," the airline feels, "must place the Dart practically at the top of the list for overall reliability of any type of powerplant in commercial service anywhere in the world."

ULSTER AIR-FERRY BOOM

TRAFFIC on the new Silver City air-ferry route between Stranraer and Belfast is now on a scale at least equal to that of sea traffic. Since sea-ferry traffic is not thought to have dropped, it is assumed that the air service is generating new traffic between Ulster, Eire and Scotland. In July, easily the best month since the introduction of the new ferry in April, over 500 cars and 1,465 passengers were flown between Stranraer and Belfast. Between September 13th and 20th over 100 extra flights will be operated to carry cars and motorists to and from the T.T. motor races.

AVIATION AND BRITISH TOURISM

AS in the past, the 1954-55 annual report of the British Travel and Holidays Association contains much information of interest to the airline industry. Last year there were 901,000 visitors to Britain, of whom 37 per cent arrived by air, compared with a total of 819,000 in 1953, when 36 per cent came by air.

The source of the greatest number of tourists was, of course, the United States. Britain was visited last year by 203,000 Americans, of whom 97,000—nearly one in two—used air transport; this latter total was 15,000 more than the number of American visitors who flew to Britain in 1953, whereas ships carried only 1,000 more last year than in 1953. Visitors from Canada, however, showed a marked preference for sea travel; of the 52,000 Canadians who came to Britain in 1954, nearly 36,000 came by ship. Most air-minded of all visitors were the Swiss: 53 per cent of the 13,000 visitors from Switzerland came by air.

BRITANNIA ROUTE TRIALS

DETAILS of an extensive programme of route-proving trials with the third production Britannia (G-ANBC) are announced by the Bristol Aeroplane Co. Altogether nine flights, involving 250 hours' flying and a route-mileage of 73,000, are scheduled for completion in 30 days.

For these trials, which form part of the C. of A. trials, the Britannia will be flown and staffed by B.O.A.C. crews. The Corporation plans to introduce Britannias into regular service early next year on the London-Johannesburg Springbok route. All the proving flights will be conducted as though the aircraft were in normal airline service. The Britannia will operate to schedule and will be fuelled and serviced entirely in accordance with routine airline practice; intermediate stops will be made at different airports according to the type of service being simulated, and turn-round time at each point will be kept as low as possible.

The Britannia will fly from Filton to London Airport at the beginning of each flight and will return to Filton *via* London Airport. The full programme is as follows:—

Flight 1: London - Johannesburg, *via* Cairo, Nairobi and Livingstone, returning to London *via* Nairobi, Khartoum and Rome (12,600 miles); *Flight 2:* London - Idris direct and return (2,900 miles); *Flight 3:* London - Tel Aviv direct and return (4,500 miles); *Flight 4:* London - Johannesburg, *via* Cairo, Nairobi and Livingstone, returning to London *via* Nairobi, Khartoum and Rome (12,600 miles); *Flight 5:* London - Johannesburg, *via* Rome, Cairo, Entebbe, Nairobi and Livingstone, returning to London by the same route (13,000 miles); *Flight 6:* London - Bombay, *via* Cairo and Karachi, returning to London *via* Cairo (9,900 miles); *Flight 7:* London - Idris direct and return (2,900 miles); *Flight 8:* London - Tel Aviv direct and return (4,500 miles); *Flight 9:*

CIVIL AVIATION . . .

London - Karachi, via Cairo and Bombay, returning to London via Cairo and Rome (9,900 miles).

Outlining the purpose of the trials, the manufacturers recall that "before certifying any new airliner as cleared for passenger-carrying service, the A.R.B. demands that, over and above the satisfactory fulfilment of all the exhaustive tests called for in the Civil Airworthiness Requirements, the aircraft shall be operated over representative airline routes in a faithful simulation of normal airline operations. The extent of such trials varies according to the individual aircraft; in the case of the Britannias, which have already completed well over 2,000 hours' development flying, the Air Registration Board has asked for only 250 hours of route-proving for the Series 100 aircraft. The programme is nevertheless severe in that it schedules the flights for completion in 30 days, which is equivalent to an annual utilization of 3,000 hours.

"No matter how much flying is carried out at home during the aircraft's initial development, new faults may still be revealed by overseas operation on a routine airline basis to hot, sandy, humid and climatically extreme airfields. The function of the tests is to bring to light any such 'snags'. . . . The trials also make possible a realistic exploration of the various ways of operating the aeroplane. From the wealth of information accumulated during earlier flight testing, a variety of flight patterns has been drawn up. On the basis of these, performance figures will be recorded during each flight for various procedures, such as level cruising, stepped climbs, drift climbs, high-level economical cruising, low-level fast cruising, three-engine cruising, three-engine drift downs, etc., all in varying conditions of ambient temperature and all-up weight."

For the trials B.O.A.C. are providing flight and cabin crews totalling 17 captains, specialist navigating and radio officers, stewards and stewardesses. For all flights but those to Idris, the aircraft will be staffed by double crews, who will exchange duties on different sectors of the routes. As many members as possible of B.O.A.C.'s Britannia Fleet will thus be given first-hand operating experience. Capt. A. S. M. Rendall, Flight Superintendent of the Fleet, and Capt. F. W. Walton, Officer-in-Charge, Training, will take alternate flights as members of the double crew staffs.

The basic crew for each flight will comprise three pilots, one engineer, a specialist navigating officer, and a specialist radio officer. On the first and third Johannesburg flights and the first Bombay flight, two radio officers will be carried to operate the radio installation the whole of the time as part of the programme for proving the radio system. A Bristol test pilot will travel on each flight, and the Britannia will carry a passenger complement of technicians and engineers from both Bristol and B.O.A.C. The actual number of passengers will vary from flight to flight but on the Idris flights, which are intended primarily to provide practical tests of the cabin atmosphere system in a hot climate, the Britannia will carry a full complement of 90 passengers.

It is expected that the first of the Britannia's nine overseas flights will be completed within the next few days.

CONVAIR JET TRANSPORT

AN artist's impression in *Aviation Week* shows a proposed Convair jet transport design strongly resembling both the Boeing 707 and Douglas DC-8. If built, it would have the same powerplants as its competitors—four P. and W. J-57s. Our contemporary reports, however, that Convair is not actively engaged in a sales campaign because of the belief that "there will not be enough business for even two companies, let alone three." Intended to carry 80-135 passengers on transatlantic flights at 550 m.p.h., the projected Convair would have a gross weight of 200,000 lb.

DC-8s FOR NATIONAL?

ACCORDING to a Washington report, a firm order for six Douglas DC-8 jet transports has been placed by National Airlines, who are said to have been given definite delivery dates. The price of the aircraft was quoted as £1,640,000 each plus £500,000 for spares. The order was announced by National's president, Mr. G. T. Baker, when giving evidence before a C.A.B. hearing of the airline's application for permission to fly the New York to Florida route.

Another of America's domestic carriers, Eastern Air Lines, has also announced new purchases. One of the company's vice-presidents states that Eastern have ordered 20 more DC-7Bs for delivery between October 1956 and April 1958. Styled "Golden Falcons" by Eastern Air Lines, five DC-7Bs of an original order for 20 have been delivered and the remaining 15 are due to enter service over the next twelve months. He also forecast that Eastern Air Lines would shortly announce the purchase of both turboprop and turbojet transports. Other sources report that a large Eastern order for Lockheed Electras is likely.

S.B.A.C. COST METHOD REVISED

ANNOUNCING the publication of *Issue 3 of the Standard Method for the Estimation of Direct Operating Costs of Aircraft*, the S.B.A.C. states that the previous issue's provisional values for maintenance and overhaul of turbine engines were found to be slightly pessimistic. Sufficient operating experience has been gained for new values to be prescribed with confidence. Other changes include an increase in labour rates and a reduction in the insurance premium and fuel costs. New fuel reserves have been adopted.

"Experience with the Method," the S.B.A.C. announcement adds, "showed that the detail of some of the standards implied an accuracy greater than methods of this type can hope to achieve and various simplifications have been made." The Method's main object, it notes, is "to provide a yardstick for the first comparison of the operating costs of competitive current production aircraft. The operator is encouraged to modify the formulæ to fit his actual operating circumstances, as no standard method can account faithfully for the multitude of variations of conditions between one operator and the next."

Copies, price 5s, may be obtained from the Technical Section, Society of British Aircraft Constructors, Ltd., Summit House, 1/2 Langham Place, London, W.1.

BREVITIES

THE first Central African Airways Viscount will be named *R.M.A. Malvern*, in honour of the present Federal Prime Minister, Sir Godfrey Huggins, who was educated at Malvern College. The remaining four will be named *Matopos, Mlanje, Mweru* and *Mpika*.

* * *

Using 50-seat North Stars, T.C.A. will inaugurate tourist services between Canada and Florida, Bermuda and the Caribbean on November 1st at fares of up to 34 per cent below present first-class rates.

* * *

Dunlop tubeless tyres are to be fitted as standard equipment on future Viscounts for B.E.A. The manufacturers expect that this type of tyre will soon become standard on all new aircraft, both civil and military.

* * *

According to radio reports, the "East German Lufthansa" will begin regular flights in September. Initially, at least, aircraft will be commanded by Russian captains but will carry German co-pilots and other crew members.

* * *

The Comet 3 prototype, which is being used as a development aircraft for the Series 4, is expected to fly to Johannesburg late in 1955 or early next year for hot-weather, high-altitude trials.

* * *

The Super Constellation freighter fleet of Seaboard and Western Airlines will be increased from four to six aircraft in January 1957. The two new aircraft (which, with spares, will cost £1,400,000) will be L.1049Hs capable of lifting up to 20 tons each. The order follows the approval last June of Seaboard's application to fly scheduled all-freight services between the United States and Europe; no plans for operating scheduled services have yet been announced by the company.

* * *

It is reported that Ceylon's new international airline, to be operated by K.L.M. on behalf of the Ceylonese Government, will be known as Airways International. Services linking Colombo with London, Japan and Singapore are planned.

* * *

Two L.1049G Super Constellations were flight-delivered to Lisbon on August 8th. The aircraft will be operated from T.A.P.'s base at Lisbon to Angola, Mozambique and Rio.

* * *

Plans for a merger have been announced by two Australian airlines—MacRobertson-Miller Aviation Co. and Airlines (W.A.). Shareholders are being asked to take out shares in a proposed new company with a nominal capital of £2m.

* * *

Disagreeing with his colleagues on the recent decision to buy three Viscounts, one of the directors of New Zealand National Airways Corporation, Mr. H. Worrall, has resigned from the board. Mr. Worrall is said to have wished the question to be postponed for two years "because the Viscount had not yet been tried out under conditions similar to those in New Zealand."

* * *

Sponsored by the Technological University of Delft, the first in a series of annual lectures commemorating the late Dr. Albert Plesman will be given by Mr. J. D. Pearson, managing director of the aero engine division of Rolls-Royce, Ltd., who will speak on *The Development and Future of the Turbine Engine for Civil Aircraft*. The lecture is to be given in one of the Delft University's lecture halls at 3.30 p.m. on September 12th.

The Vickers Valiant is powered by ROLLS-ROYCE
AVON ENGINES
FOR SPEED AND RELIABILITY

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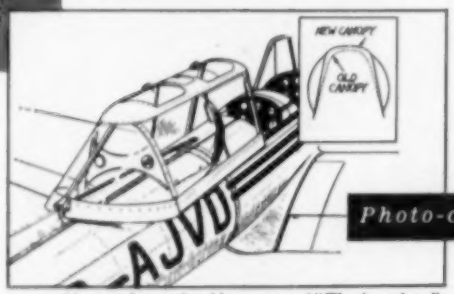

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Part of the crowd of 20,000 people who watched the racing and aerobatics at the "Coventry Air Pageant" at Baginton.

COVENTRY'S DAY

—*of Outstanding Flying: French Sweep Aerobatic Board*

"FLIGHT" PHOTOGRAPHS

DISPLAY and race flying at their best formed the bill at Baginton Aerodrome on Saturday last, to delight a sun-baked crowd of 20,000. The last round of the 1955 National Air Races; the King's Cup Race; a varied air display; something new in the shape of the Lockheed Aerobatic Competition: this was the programme. Highlights of the day's flying proved to be a number of extremely close race finishes, and some memorable aerobatics of a class not seen at British displays for some years past.

The morning was devoted to the final races in competition for the six "class" trophies, the first three rounds of which had been flown at Swansea, Yeadon and Bristol at earlier meetings. The fast merchants—Marler, Paine and Clifford in their familiar Falcon Six, Speed Six and Mew Gull—were first away, each with thoughts of the S.B.A.C. Challenge Cup. Unfortunately Fred Dunkerley (entrant of the Mew) had withdrawn his Sparrowjet, following a family bereavement.

Starting intervals for the Speed Six and the Mew Gull were approximately one and two minutes respectively behind Marler in the Falcon Six, who stayed ahead all the way to win. Clifford passed Paine on the third lap and very nearly closed with Marler on the final run in.

Taxying back after landing, Clifford hit one of the positioning markers, damaging the Mew's airscrew tips. On total points over the four meetings, he had won the S.B.A.C. Cup, but his participation in the King's Cup race that afternoon now appeared doubtful unless a replacement prop could be fitted.

Dunkerley's withdrawal from the Gemini-class Goodyear Cup race left the twin twins of Blamire and Somers, Minor and Major-powered respectively, to fight this one out between themselves. Somers had some two minutes to make up—which he did, cutting past the Coventry pilot's gold machine on the aerodrome boundary, to win his first trophy of the day.

Catering for Proctors, the race for the Air League Challenge Cup produced an exciting and extremely close finish. Barker and Knox had taken off together, followed by Husbands and Buster Paine; on the second lap Knox obeyed the injunction "Running-in—Please pass" adhering to Barker's fuselage, and subsequently stayed in front. On the final approach to the pylon, the trio chasing Knox's black machine had closed up tightly together, and Paine had moved up one place. Knox, winner of the day's race, had been the only pilot to score in each of the previous three, and thus earned the actual Cup by a handsome points margin.

The mixed bag entered for the Kemsley Trophy race spent the first two laps closing steadily and were well bunched up, with Ogilvy's Comper Swift in the lead, at the end of the third. Johnson (Hawk Trainer 3) and Somers (Chipmunk) moved up together, however, and provided the crowd with a low, close finish. Nat Somers, winner of the fourth round as of each of the previous three, had achieved full marks, the Kemsley Trophy, and the 1955 British Air Racing Championship.

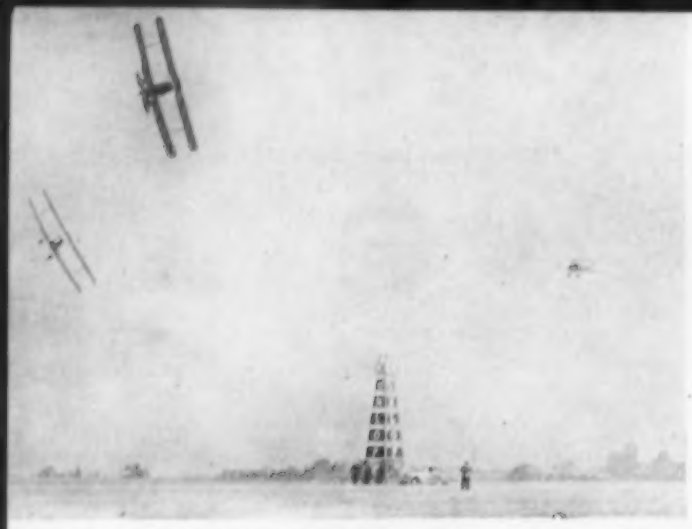
The Norton-Griffiths race, as in this year's previous rounds, comprised what might be called a straggle-gaggle of Tigers, beating round their three laps with determination, proximity, and very little height. Again the handicappers were in good form, although in the almost simultaneous arrival (rather higher than usual—ship-shape and non-Bristol fashion?) it could be discerned that Denyer had won (round, race and trophy), with Donald second and The Hon. Peter Vanneck third.

Winner of the British Lockheed International Aerobatic Competition, Leon Biancotto receives his award from Sir John Boothman.

This year's King's Cup winner was Peter Clifford, flying Fred Dunkerley's Mew Gull, which previously won this race in 1938.

The first four races had been over four laps of a short (six-mile) circuit, and the last two over three laps. The final morning race was for the Grosvenor Cup. Although there were four starters, Bough (Autocrat) was disqualified for turning inside one of the pylons on the first lap. Westoby in Aiglet G-AMMS pulled up from last place to first in the final lap, and Miss Leaf just managed to stay ahead of Gregory's Taylorcraft to come in second. Now level on total points, Westoby and Gregory were joint champions in this class.

An impressive display of aerobatics by Santiago Germano in his



Left: Round the pylon in the Norton-Griffiths race for Tiger Moths. Above: French victors in the aerobatic competition, F. d'Huc-Dressler (third), L. Biancotto (first), A. Hisler (second). Opposite page: Foreign aerobatic visitors are, from top left round the clock, Stampe S.V.4A, Sipa Minijet, Focke-Wulf Stieglitz, Bücker Jungmeister. Far right: This year's British Air Racing Champion, J. Nat Somers.

COVENTRY'S DAY . . .

Focke-Wulf Stieglitz was the last of the morning items. During the lunch interval, work progressed on the Mew Gull, Buster Paine having offered the 7ft airscrew from his Proctor as a replacement for that of the Mew, which was 3in smaller in diameter. This was fitted, and checked on a subsequent air test.

Although, unfortunately, we were not to see Gerben Sonderman as a contestant in the Lockheed aerobatic contest, he vigorously bade farewell with a dashing display in the Fokker S.14 before flying it back to Schiphol. First afternoon act of the programme proper was a potent, polished performance by six Sea Hawks of 800 Squadron, who burst in to begin a superb show, formation runs by four machines plus low individual cross-over beat-ups.

An S-51 Dragonfly of 705 Squadron, R.N., next proceeded to demonstrate its winching abilities, which were duly appreciated by the crowd—although its subsequent tendency to fly around during other items on the programme, drowning the commentary and blowing pieces of Baginton over the assembly, was not. The programme continued with appearances by four Canberras from Marham and a Shackleton from St. Eval, together with what the printed programme listed as "Event 10. Sensational aerial trapeze act by ANDRE JAN, THE HELICOPTER GIRL." Putting aside any temptation to employ such phrases as low-drag aerodynamic bodies, streamlined double-curvature fuselages and the like, we would record that the Agusta-Bell 47G from which the trapeze and Miss Jan were suspended was flown by John Crewdson.

Sharp contrast—essential for a well-balanced show of any kind—was next provided. In turn came Olympia sailplane aerobatics by George Thompson of the Coventry Gliding Club; steady runs by a B-29 of the U.S.A.F.; and a lively aerobatic performance by F/O. B. A. Clayton in a Vampire T.11.

For the 1955 King's Cup race, the top fifteen pilots in this year's British Air Racing Championship were competing over four laps of a 17-mile circuit. The machines varied from the Tiger Moths of Vanneck, Maile and Denyer, at about 107 m.p.h., to the Mew Gull flying at twice this speed. Thus it was only as Vanneck came round the pylon, after completing two laps in the lead, that Clifford in the Mew Gull was flagged away on take-off.

The gaps continued to close, and Clifford moved up steadily, but at the final turn in towards the field Vanneck was still leading. The close group of dots gradually approached and became an assorted gaggle of aircraft with, it seemed, Vanneck a certain winner. At the last moment, however, shooting out of the grey haze and through the other aircraft like a sharp white bullet, came the Mew Gull, to win the 1955 King's Cup in one of the closest finishes this race has ever seen. Vanneck was second and Johnnie Johnston third: a special prize should certainly have gone to the handicappers. Engine trouble had forced Ogilvy to make an emergency landing just short of the finishing line. The results are listed on page 279. The finals of the aerobatic competition followed.

The Lockheed Aerobatic Competition.—Belief that the judges of the British Lockheed International Aerobatic competition would have an unenviable task was borne out in the event, which took place on the Friday evening and Saturday afternoon. The winners must all have been within a mark or two of each other.

There was admiration for Santiago Germano, who had come so far and whose Argentine-built Focke-Wulf Stieglitz only left its crate at 1 a.m. on the day of the elimination event. There was pleasure that such a wide variety of aircraft were present to compete for the international title. There was also disappointment that Gerben Sonderman was prevented from competing.

Few were present on the Friday to see Sonderman's masterly handling of a difficult situation during practice. While he was inverted, and after he had sensed some electrical trouble when his radio faded, the flame went out in his Nene turbojet. On regaining level flight he appeared to try to relight, but without success. He then brought the Fokker advanced trainer round and made a beautifully judged dead-stick landing, rolling up almost to his chocks in front of the tower. It seems that the quill-shaft driving his generator had sheared. Power was soon consumed in the batteries, and then the fuel dried up because the booster pumps faded out as he was flying inverted. Some enterprising work by friends at Coventry had the S.14 serviceable by Saturday.

The first round of the competition started on the Friday evening.

François d'Huc-Dressler led off in the Stampe S.V.4A biplane. The Renault 4PO5 engine was modified for inverted flight; and, like the other foreign competitors to follow, the Frenchman made great use of this quality in bunts, outside loops and other inverted manœuvres. His set figures—slow roll, loop, half roll-off-the-top, were all included in a non-stop variety of unusual and composite turns, very hard to identify and evaluate separately. All were competently executed with very few errors, and it was no surprise later to find his name among those of the six finalists. He was notable for using only a small area of sky.

W. H. Bailey (Miles Hawk Trainer), **G. R. I. Parker** (Blackburn B.2 Trainer) and **F. C. Fisher** (Tiger Moth) were much handicapped by lack of power and of inverted-flying carburettors. Their displays, even allowing for this, were not such as to put them in the running.

Leon Biancotto, of France, using the same Stampe as his compatriot, snapped straight into a continuous whirl which, so far as we could see, comprised one-and-a-half flick rolls into an inverted dive, rolling into a half loop. Without pause, a stalled turn and inverted flight followed, then a bunt and Biancotto's version of a flick roll on top of a loop (closely resembling the Porteous avalanche, but less flat). His manœuvres continued in quick succession, well positioned and most competently executed, until the yellow Very indicated five minutes up. For the final, we felt sure.

R. L. Portecus, in a very clean Auster J5L Aiglet (Gipsy Major 10) next took the arena—one of the favourites on reputation, but using a standard cabin aircraft by no means ideal for aerobatics. He opened

NATIONAL AIR RACES—FOURTH ROUND (BAGINTON) AND FINAL PLACINGS

Place	No.	Pilot	Aircraft	H'cap	Speed	Total pts.	Final place
S.B.A.C. Challenge Cup							
1	92	G. Marler	Falcon Six	00.00	160	50	3
2	97	P. S. Clifford	Mew Gull	2.09	195.5	53	1
3	96	R. R. Paine	Hawk Sp. Six	1.08	167.5	52	2
—	98	F. Dunkerley	Sparrowjet	withdrawn		12	4
Goodyear Challenge Trophy							
1	85	J. N. Somers	Gemini 3	02.10	161	58	1
2	80	P. Blamire	Gemini 1a	00.00	134	32	2
—	84	P. Dunkerley	Gemini 1a	withdrawn		26	3
Kemsley Challenge Trophy							
1	47	J. N. Somers	Chipmunk	01.46	138	71	1
2	43	J. R. Johnston	Hawk Tr. 3	01.27	134.5	48	2
3	41	D. F. Ogilvy	Comper Swift	00.57	128.5	48	3
4	40	A. J. Spiller	Messenger 2a	00.35	123.5	21	4
5	46	W. H. Bailey	Hawk Major	00.00	117.5	6	7
—	48	D. W. Phillips	Hawk Major	withdrawn		15	6
Norton-Griffith Challenge Trophy							
1	23	J. H. Denyer	Tiger Moth	00.10	105.5	67	1
2	24	J. M. Donald	Tiger Moth	00.10	104.5	39	4
3	22	P. Vanneck	Tiger Moth	00.02	103	45	3
4	28	L. R. Williams	Tiger Moth	00.00	102.5	9	6
5	21	B. Maile	Tiger Moth	00.14	103.5	58	2
6	25	B. J. Snook	Tiger Moth	00.07	102	28	5
Grosvenor Challenge Cup							
1	9	D. Westaby	Aiglet	02.46	119	58	1
2	3	Miss F. M. Leaf	Tipsy Tr. 1	00.00	94.0	30	3
3	5	C. Gregory	T'craft Plus D	01.53	110.5	58	1
—	11	A. A. Baugh	Autocrat	01.40	disq.	6	8
Air League Challenge Cup							
1	69	T. G. Knox	Proctor 3	00.00	137.5	61	1
2	68	A. Barker	Proctor 3	00.00	136.5	40	2
3	65	A. S. K. Paine	Proctor 1	00.32	142	27	4
4	67	E. N. Husbands	Proctor 1	00.05	136.5	30	3

with a spin of two-and-a-half turns, checked precisely and then half-rolled, following with a loop and a loop plus avalanche. He conserved his height well, did some nice stalled turns, a barrelly roll, a reluctant upward roll and a delightful rocket loop—a pleasing little aerobatic overlooked by all other contestants. We wrote after this: "Precise and confident display; no bad manœuvres considering aircraft capabilities; good positioning. Certain finalist on form so far."

Now there was promise of a spectacular show, for we had seen **José Aresti** of Spain during practice, and we know the Bücker Jungmeister. In fact, he was lucky to be competing, having earlier in the day "lost his prop," landed dead-stick down-wind and ground-looped.

He employed an up-and-down-the-field technique and kept his manœuvres extremely compact. From the starting green light he went into a spiral dive (not the "spin" mentioned by a commentator, and too fast and barrelled for an aileron turn). This was followed by an outside loop. With the Bücker's aid he was able to demonstrate two quick flick rolls and, later, one-and-a-half stopped exactly in the inverted position. Finally, he did hesitation and barrel rolls. If we had any criticisms, they were that his loops were pulled rather tight on top and were thus oval, and that from one of his rolls-off-the-top he emerged some 15 deg out of line. His very long slow roll was a joy to watch. In Aresti's display, flicks were frequent, the acceleration of the Bücker was noticeably brisk, and his use of the engine was very smooth.

The squeal of the Minijet was next heard as it climbed away in the hands of **Alain Hisler.** This attractive little French twin-boom machine had much in its favour for this competition. Opening with a long, fairly steep dive, Hisler pulled up into two vertical rolls, going into a loop and an aileron turn vertically down, to return across the arena again. This colourful composite, and two variations on it, were the highlight of his display. The set manœuvres were well executed, and a snappy eight-point roll was added for good measure. Hisler was the first to demonstrate a Derry turn—so-called in honour of its inventor John Derry in France as well as in this country. For the spectator, no more could have been asked. The judges, we felt, must have deducted a mark or two for flying below the 300ft limit, and perhaps for taking up rather too much sky.

Dick Wheldon was next off in the Provost. In this R.A.F. standard basic trainer, he concentrated on the set manœuvres—especially the slow roll—and no one did them better. His four-point and series of rapid rolls, using the Provost's pleasant ailerons to good effect, were appreciated, as was his steady final outside turn through 180 deg. But for an occasional wander away from the arena we found no fault. That, surprisingly, the Provost did not qualify for the final (as we learned later) was perhaps because there was a little less scope and artistry, to quote the official headings under which marks were awarded.

Cloud and light were becoming a little trying for jet aerobatics when **Mike Kilburn** got his green in the Vampire Trainer. Here again, the set manœuvres were immaculate and the hesitation roll was neat. Tail-slides—apparently mentioned in advance to the commentator—did not come off, but the Vampire showed a very gentle straight stall. Kilburn seemed to be looking for ceiling on occasions, but kept his display commendably compact for a side-by-side jet. What he did, he did competently. We wrote him down as a likely finalist, but felt that he might not have done quite enough.

Geoff Worrall, Gloster's chief production test pilot, now took over in the arena with the pale blue Meteor P.V. 7/8. He surprised us with an early half-bunt, and here was another British pilot to shine in the set manœuvres, particularly the slow roll. Naturally, the Meteor needed a lot of sky but Worrall appeared to have it well gathered. The great sweeping climbing turn with Worrall on the outside, which came near the end, probably earned him a bonus. We liked his show, wondered if he had done quite enough, and placed him level with Mike Kilburn.

Final contender was **Santiago Germano,** the leathery little Argentinian, by no means young, but with a great spirit—and a smart black bonnet. He did not see his first greens for starting; and when the next two were fired, an itinerant survey Anson blundered over the airfield below him exactly in the sky he was to use. After more delay he began his display. No one did more in quick succession, outside loop, another loop, roll off, two-and-a-half turns of spin, a rolling turn and even an attempt at a hesitation roll. Whirling in the distance his old Stieglitz at times reminded one of a Swordfish. A straight and prolonged inverted pass, half outside loop, another loop and a slow roll, took him up to the yellows. It was an exhilarating display but, one felt, unduly cramped and complicated. Neither pilot nor spectators had time to breathe.

The judges later announced their selection of finalists as Aresti, d'Huc-Dressler, Biancotto, Hisler, Porteous and Worrall.

The Finals.—José Aresti really worked hard in his final display on Saturday. From a half outside loop he went into an upward flick, checked level and dropped into four or five tight turns of spin. Again his flick manœuvres were excellent, in both directions, and his long slow roll pleased. The four-point hesitation roll was not quite straight. His circuit of continuous left-hand rolls was most skilful. Concentrated, polished, perhaps a little too much packed into the time, we felt.

Biancotto was No. 2. He started quite high, flicked into position for a half outside-loop, rolled up and out and returned from a very stalled turn. The engine dragged him round a bunt, and this was followed by a very smooth roll off and a loop with full flick on top. He sensed that he was leaving the judges a little and returned to position before making a beautiful slow roll and a rolling circuit. Allowing for the difference in aircraft, we wrote that he was probably "a few marks up on Aresti." We believed that one or two of his manœuvres were better executed in the heats.

Next came Alain Hisler, to repeat almost exactly his display of the previous day, including the dive below height—perhaps his altimeter lags. The Minijet certainly is a joy to watch and it is very hard to decide whether very long flowing manœuvres are better for competition than more compact ones. He might have added a little to his repertoire for the final. No aircraft looked snappier.

Ranald Porteous now opened from the sunny side with a taste of spin checked precisely. On to his back and down, he placed a nice round loop before the judges, followed with a stalled turn, loops with avalanches, and used a rocket loop effectively to gain some height towards the end. His upward roll was a brave manœuvre for the Auster. Exactly on time, he wagged his wings to clock off. This, we felt, was his best show and, within the capabilities of the aircraft, above reproach. The rolls off were unsurpassed for smoothness and straightness, the slow roll necessarily a little barrelled. We did not place Porteous first in our private classification, but by no means last either.

Now for Worrall and the Meteor in near perfect weather; enough sky to give him room, enough cloud to spare the eyes of the crowd. He opened with a long inverted climb and a half bunt, then came down again in a series of smooth aileron turns. A huge loop followed, but with the turn-back it took him too far into the sun for good positioning. His slow roll was a joy; his roll off we failed to notice, if, in fact, he did one. Again the long, outside climbing turn and, as well, a signing-off wag of the wings on his back. Was this better than on the first attempt? Yes, we thought, but still rather limited in scope. We do not under-estimate the added responsibility which this largest and fastest competing aircraft brought in such a competition.

And finally came d'Huc-Dressler, in the Stampe, with a programme similar to that of the previous evening, except for a slightly shaky start which included a not-too-straight outside loop. From a loop, he rolled off downward and then, getting into his stride, slow-rolled beautifully, four-point-rolled from inverted to inverted, and pulled through into a half bunt. His smooth rolling circuit on a steady curve was the best of the competition, and possibly the most difficult sustained manœuvre. We liked d'Huc-Dressler a lot, but felt that he started off less well in the final than in the heats. It seemed that the two Frenchmen using the same Stampe must be placed. Results are tabulated on p. 279.

The final items in the afternoon's air display—which had been an excellent example of good timing and organization throughout—were well up to the earlier standard. Four Fairey Gannets of 820 Squadron, Eglinton, exhibited first-class teamwork in the air before landing, folding their wings and—one fewer than before—taking off again; Rene Vincent made a triple parachute drop from an Auster; and, to wind up the afternoon's flying with as superb an exhibition as it opened, four Hunters of 54 Squadron appeared in their best and tightest formation behaviour. Led by Capt. R. G. Imming, U.S.A.F. (on exchange posting with the R.A.F.), this quartet produced formation rolls that were a joy to watch, together with formation-changes during rolls.

Coventry's day, which ended with the official prizegiving by Air Chief Marshal Sir John Boothman, had been a day of outstanding flying. The City Corporation, the Royal Aero Club and the local aircraft-industry firms, who had organized and supported the meeting, indeed deserved congratulation.

When Her Majesty visited the Isle of Man last week, the Queen's Colour was paraded by the Guard of Honour from Jurby.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Operation New World

NO squadron of the Royal Air Force has stronger ties with an external community than has No. 139 with Jamaica. Heralded as "our bomber squadron" in the Jamaican Press and with the streets of the capital, Kingston, decorated and Union Jacks flying from every mast, the eight Canberras of the squadron flew in on August 11th to begin a five day visit. As A. V-M. J. R. Whitley, A.O.C., No. 1 Group, who had piloted the leading Canberra, stepped from his aircraft at 4.30 p.m., he was greeted by the Governor, Sir Hugh Foot. The next to greet A. V-M. Whitley was the man who had made the initial move in May, 1940, to open a fund to subscribe money to buy aircraft for a bomber squadron—Mr. Alexander Gordon, a prominent citizen of St. Ann.

On Saturday last more than 10,000 people were expected at the airport to see the squadron's demonstration and the Canberras were scheduled to fly over most of the centres of population before departing for British Guiana last Tuesday.

The Canberras had little trouble on the 5,500-mile outward journey, although conditions for landing at Keflavik, Iceland, and St. Hubert, Montreal, were very poor with a cloud base of less than 1,000ft at both places. Times for the five legs were: Hemswell-Keflavick (1,093 miles) 2 hr 40 min; Keflavick-Goose Bay (1,558) 3 hr 50 min; Goose Bay-St. Hubert (880) 2 hr; St. Hubert-Miami (1,426) 3 hr 30 min; Miami-Jamaica, including fly-over (600) 2 hr.

When the first Hastings arrived at Keflavik on August 9th, first news was heard of the hurricane Connie and a close interest was taken in "her" from thence onwards until Miami was reached. At Keflavik, the briefing gave Connie as 200 miles N-W of the Bahamas, at Goose Bay its 7/10 m.p.h. progress had taken her some 200 miles further and by Wednesday morning its track was swinging definitely westward towards the Carolina coast. To the Canberras Connie presented no problem as they passed overhead with some 25,000 feet to spare but the pilots of the five Hastings had to keep closely in touch with developments.

The first Hastings had a good view of the hurricane area while over the coast of S. Carolina. A great grey wall of cloud marked the eastern fringe of the 200-mile-wide belt of swirling air, swinging round the central area of relative calm. This dead area, known as the "eye" of the hurricane, had been reported by U.S. Navy pilots as being some thirty miles across. Around it wind velocities of up to 150 m.p.h. were estimated. All five Hastings avoided the disturbance and landed in Jamaica either at Palisadoes or Montego Bay.

Although 139 Squadron's pilots did not recognize Connie they struck huge cumulonimbus clouds, probably associated with the disturbance, stretching up to 48,000ft, and in one case to more than 50,000ft over the Carolinas. In the latter case F/O. Anderson went through the cirrus anvil head at the top of the vast pillar of cloud although he was registering an altitude in excess of 50,000ft. Pilots who had had experience of flying in India and the Far East said they had never seen cumulonimbus extend to such a vast height.

H.M.S. "Eagle," now with angled deck entering the Grand Harbour at Malta. The carrier's complement of aircraft includes Sea Hawks, Gannets and Wyverns.

Appointments

THE following are among recent Royal Air Force appointments: G/C. T. E. J. Fitton to H.Q. No. 24 Group for air staff duties; G/C. G. L. S. Griffith-Jones, C.B.E., to Air Ministry for duty in Department of Air Member for Supply and Organization; G/C. W. G. Moseby, D.S.O., D.F.C., to R.A.F. Driffield, to command; G/C. W. T. H. Nichols, O.B.E., to the Radio Engineering Unit, to command; G/C. H. M. G. Parker to R.A.F. Kirkham, to command; W/C. G. C. Godfrey, M.B.E., to Central Signals Establishment for technical duties, with acting rank of group captain; W/C. E. R. Dutt, A.F.C., to S.H.A.P.E. for flying duties; W/C. L. C. Inglefield to No. 19 (L.A.A.) Wing, to command; W/C. K. B. J. Randall to R.A.F. Oakington for technical duties; W/C. R. A. Webster to H.Q. A.A.F.C.E. for staff duties; W/C. S. Williams, O.B.E., to A.H.Q. Malaya for technical staff duties; S/L. R. J. MacLeod to No. 1 Wing, Aden Protectorate Levies, to command, with acting rank of wing commander.

First R.A.N. Jet Squadrons

THE first three jet and turbo-jet squadrons for the Fleet Air Arm of the Royal Australian Navy were officially formed at the R.N. Air Station, Culdrose, near Helston, Cornwall, last Tuesday.

The new units are No. 808 Squadron equipped with eight Sea Venoms and Nos. 816 and 817 Squadrons, each operating six Gannets. Manned completely by officers and ratings of the Australian Navy, the squadrons are expected to go to Australia in March of next year in H.M.A.S. *Melbourne*, the new aircraft carrier for the R.A.N., now building at Barrow-in-Furness.

In Australia, they will be disembarked to the Naval Air Station at Nowra, New South Wales, headquarters of the Australian Fleet Air Arm.

The formation of the new squadrons was marked by a ceremony attended by the High Commissioner for Australia, Sir Thomas White, K.B.E., D.F.C.

An impression of the Capital Airlines Viscount flying over the Capitol building, Washington

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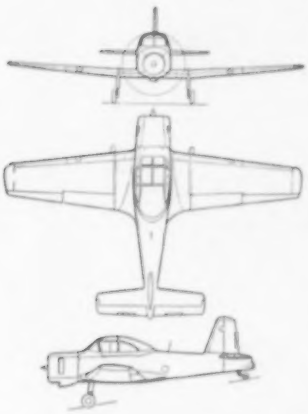
AIRCRAFT OF THE COMMONWEALTH—1955

THE pages which follow outline the features of 19 leading types of aircraft constructed in the Commonwealth factories beyond Britain's shores. They tell encouraging stories of success in the production of military and civil types under licence (skilfully adapted, where necessary, to local requirements) and in the development and marketing of original designs. In the first sphere, outstanding achievements are the Avon- and Orenda-powered Sabres of Australia and Canada respectively. Among aircraft of Commonwealth design, the CF-100 has taken its place among the world's great first-line military aircraft, and the Beaver and Otter are established at the top of a new class of post-war utility machines.

AUSTRALIA



Power plant	P. and W. Wasp Junior
Span	34ft 9in
Length	28ft 10¼in
Gross weight	4,235 lb
Max. speed	187 m.p.h.

Commonwealth CA-22 Winjeel Resembling in layout and function the R.A.F.'s Hunting Percival Provost, the Winjeel will perform an equivalent rôle as the standard basic trainer of the R.A.A.F. The prototype first flew in 1951 but subsequent progress was slowed by emphasis on Avon-Sabre development. The first production Winjeel was delivered to the R.A.A.F. in March this year and output is being progressively increased to a peak rate of about one aircraft per week. A total of 62 Winjeels are on order.

Originally it was intended that the second half of the production batch should be powered by the 450 h.p. Cicada engine but it has since been decided that all Winjeels will have the 455 h.p. Wasp Junior. The Cicada will be kept as an "insurance" design for emergency production.

Of simple, robust construction, the all-metal Winjeel has side-by-side seating for instructor and pupil and—following immediate post-war R.A.F. practice—a second pupil's station behind the right-hand seat. A four-piece petal cowling gives access to the entire engine installation.

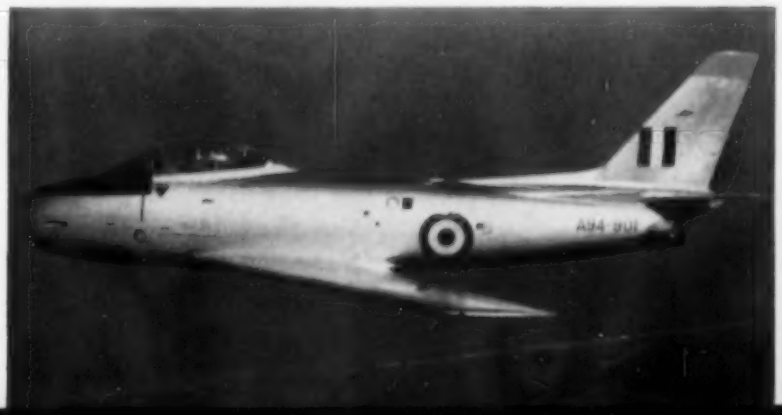
Commonwealth CA-27 Avon Sabre. Australia's decision, taken in 1951, to build an Avon-powered version of the Sabre has given the R.A.A.F. one of the world's outstanding day fighters. This combination of North American airframe and Rolls-Royce engine has proved no less effective than the Merlin-Mustang of World War II renown. The prototype CA-27 first flew in August 1953 and the first production aircraft was handed over to the R.A.A.F. a year later. The original order was for 72 Avon Sabres but this was subsequently increased to 90 and additional orders are expected.

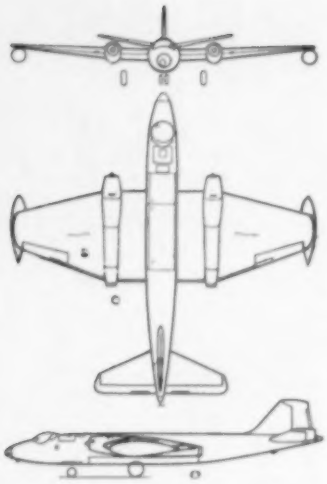
Design of the CA-27 was based on that of the F-86F but the Australian version has a considerably higher performance than the original, being powered with a Commonwealth-built Avon 20 giving 50 per cent more thrust than the American J47. Consuming 25 per cent more air than the American turbojet, the Avon required a larger intake and this is a distinguishing feature of the CA-27 Sabre.

Some 60 per cent of the Sabre's fuselage structure was entirely redesigned by Commonwealth Aircraft. The major differences include a rearward movement of the engine installation (being some 400 lb lighter than the J47) and the installation of two 30 mm Aden guns in place of the original armament of six .50in guns. Provision is made for carrying external war loads of bombs or rockets up to a maximum of 4,000 lb. No details of performance have yet been released but the Avon Sabre is known to have a top speed of at least 700 m.p.h. and the improved power-weight ratio resulting from the use of the Avon undoubtedly confers a climb performance superior to the vast majority of Sabres elsewhere.

Power plant ...	C.A.C.-built Avon 20
Span	37ft 1in
Length	37ft 6in
Gross weight	17,000 lb
Max. speed	700 m.p.h.

Above and upper left, Winjeel; below and left, Avon-Sabre.



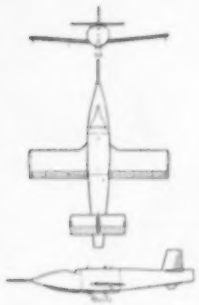


Power plant ...	C.A.C.-built Avon
Span	63ft 11½in
Length	65ft 6in

Aircraft of the Commonwealth . . .

D.A.P. Canberra Two R.A.A.F. bomber squadrons have now been re-equipped with Australia's version of the Canberra—three-seat tactical bombers designated B.20 and based on the British-built B.2 Differences between the two include the installation of Commonwealth-built Avons and of Australian radio instrumentation and other operational equipment. Production is undertaken in the Government aircraft factories for the Defence Department's Division of Aircraft Production. The initial order was for 48 aircraft, the first of which flew in May 1953 but additional contracts for later versions of the Canberra (for which designations Mk.21-24 inclusive have been reserved) will keep the type in production at least until 1957. Output is at present geared to the R.A.A.F.'s peace-time requirement for approximately 20 Canberras a year, but the production line has been designed for rapid expansion in an emergency.

D.A.P. Jindivik Following successful trials with the Pika piloted prototype, the Jindivik 1 pilotless jet target aircraft made its first flight in August 1952. Twelve of these aircraft, powered by Armstrong Siddeley Adder turbojets were built, and these were followed on the D.A.P. production lines by Jindivik 2s, with short-life Viper turbojets (1,640 lb s.t.); later versions of this engine, giving up to 2,000 lb s.t., may be fitted. The Jindivik's light alloy fuselage is built in three sections, the first of which carries the autopilot, radio control and telemetry equipment; the centre fuselage houses "special equipment required for target trials" and the main crash-proof fuel tank; the Viper and its tail pipe are mounted in the rear section. Take-off is effected from an automatically released trolley, and the aircraft lands on a retractable central skid.

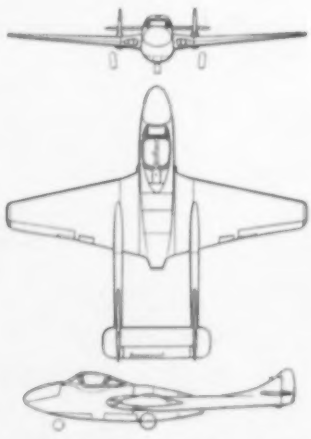


Power plant ...	Armstrong Siddeley Viper
Span	19ft
Length	23ft 3½in

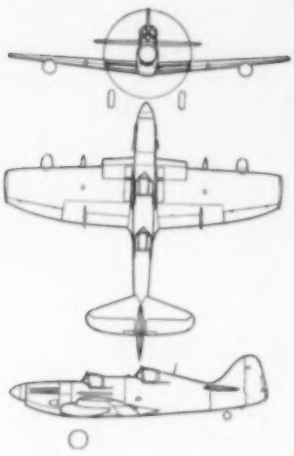
Top, Canberra B.20.

Centre, Jindivik 2.

Bottom, Vampire T.33.



Power plant ...	D.H. Goblin 3
Span	38ft
Length	34ft 6in
Gross weight	12,390 lb
Max. speed	550 m.p.h.



Power plant ..	R.R. Griffon 74
Span	41ft 2in
Length	37ft 11in
Gross weight	12,000 lb
Max. speed	360 m.p.h.

Above and left, Firefly T.5.

de Havilland Vampire The Australian de Havilland factory has been building Vampires since 1949. Completion of a batch of 80 Nene-powered Vampire 30s, which are now replacing the Mustangs of the Citizen Air Force, was followed by an order for 36 Vampire Trainers for R.A.A.F. and R.A.N. jet conversion training. Unlike the single-seat Australian Vampires, the Trainers are powered by imported Goblins, as employed in all British-built versions.

The Vampire T.33s now coming off the production line at Bankstown, N.S.W., represent the tail end of the initial order for 36. It is expected, however, that the type will be adopted by the R.A.A.F. as its standard advanced trainer, in which case it is likely to remain in demand for the next three to four years.

Fairey Firefly T.5 Produced in small quantities for the Royal Australian Navy, the T.Mk.5 Firefly is the first aircraft engineered by the Fairey Aviation Co. of Australia. Essentially, it is a pilot training conversion of the A.S.5 anti-submarine version used by the R.A.N. In place of the observer's cockpit the T.5 has a raised hood for the instructor and duplicated flying controls and instruments.

CANADA

Power plant ...	Avro Orenda 11
Span	49ft 11in (less pods)
Length ...	... ... 54ft
Gross weight	... about 37,000 lb
Max. speed ...	about 660 m.p.h.

Avro CF-100 First flown in prototype form in January 1950, the CF-100 has been developed and produced on a grand scale—as shown by the following brief biographical outline. The two Mk.1 prototypes, Avon-powered, were followed by a pre-production batch of ten unarmed Mk.2s with Orendas; these Canadian turbojets have been used in all subsequent aircraft. The first series to be built in large numbers was the Mk.3, armed with eight .50in guns. Of the 70 Mk.3s delivered, some were built as—and the majority of the remainder are now being converted to—trainer versions. Latest and most important variant is the Mk.4, which carries its main armament of 104 air-to-air rockets (or a lesser number of guided missiles) in wing-tip pods. The Mk.3's armament of eight .50in guns is carried in a central pack beneath the fuselage. While the Mk.4 has provision for a similarly placed gun or rocket pack, its omission affords an improved altitude performance.

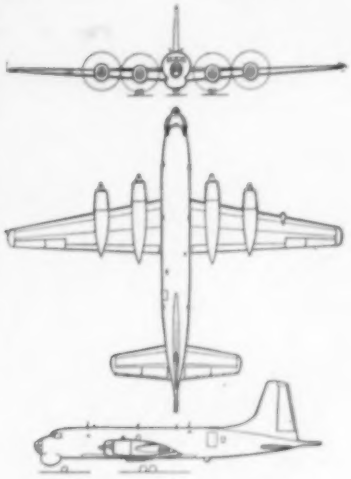
Of the current order for 510 CF-100s, well over 300 have been produced. Its makers claim that the CF-100 is "recognized as the outstanding aircraft of its kind in service today" adding that further variants will follow the Mk.4. Recently announced was a target towing version.

The plastic nose section of the CF-100 houses its Hughes search radar and fire control system, and pilot and observer are seated in tandem ejector seats. The type is credited with an operational range of over 1,000 n.m. and a ceiling exceeding 45,000ft. Maximum speed has not been revealed, but the aircraft is capable of exceeding Mach 1 in a dive.

Avro CF-105 Described as "virtually automatic," the CF-105 will be a massive (60,000 lb) two-seater capable of interception at Mach 2 in all weathers. Tooling up has begun and the first fighter is expected in 1957. The only other details of the aircraft are that it will be of delta configuration and will be powered by two turbojets delivering thrust approximating to the weight of the aircraft itself. The so-called "Super Orenda" has been named as a likely power plant, though the first aircraft may employ J75s.

Below and left, CF-100 Mk 4.

Above and right, CL-28 Britannia.



Power plant ...	Wright Turbo-Compound
Span	142ft
Length	122ft
Gross weight ...	150,000 lb
Max. speed	350 m.p.h.

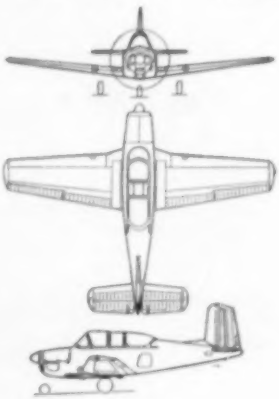
Aircraft of the Commonwealth . . .

Canadair CL-28 A much-modified version of the Bristol Britannia airliner, intended to provide the R.C.A.F. with "a flying platform for submarine detection and attack," the CL-28 will be the largest aircraft ever built in Canada. It is reported that only the wing, tail unit, undercarriage and flying controls of the original will be retained; some 60 per cent of the structure will be re-designed or modified by Canadair. The outstanding change is, of course, the use of Wright Turbo-Compound piston engines in place of Proteus turboprops, in order to give 24-hour endurance at all altitudes.

Manned by a crew of 15, the aircraft will carry a variety of armament in its two weapons bays and 21 different radio and radar installations. Beneath the glazed observation station in the nose there will be a large radome, and the installation in the extreme tail of a magnetic airborne detector boom will increase the fuselage length to 122ft, compared with the Britannia 100's 114ft. Delivery of the first CL-28 is scheduled for early 1957. It is reported that the initial R.C.A.F. order for 13 may possibly be increased to 50.

CanCar T-34A Following-up their large-scale production of Harvards (555 delivered to the R.C.A.F., U.S.A.F. and N.A.T.O. air forces) the Canadian Car and Foundry Co. are now completing the last of 125 licence-built Beechcraft T-34A trainers. One hundred of these aircraft were ordered by the U.S.A.F. in 1953 and the remainder are for the R.C.A.F. Known as the Mentor, the T-34A is a primary trainer developed from the Bonanza and designed to fulfil the same rôle as the Harvard at lower cost. Of all-metal construction, it is powered by a 225 h.p. Continental. The undercarriage, which features a steerable nosewheel, is fully retractable, and the tandem cockpit is lavishly equipped. Adopted as the primary trainer of both the U.S.A.F. and U.S.N., the Mentor is also serving in Chile, Columbia and Japan.

Canadair Sabre Outstanding among Canada's production achievements has been the building of some 1,350 F-86 Sabres, a large proportion powered by Orenda turbojets, since 1950. Production is now at the rate of one aircraft per day, with 200 more to come. The current version, the Sabre 6, is powered by the Orenda 14, which features a two-stage turbine giving

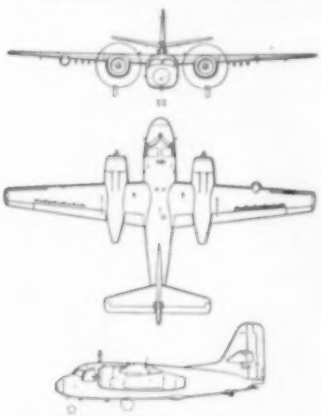


Power plant ...	Continental O-470-13
Span	32ft 10in
Length	25ft 10in
Gross weight ...	2,900 lb
Max. speed	190 m.p.h.

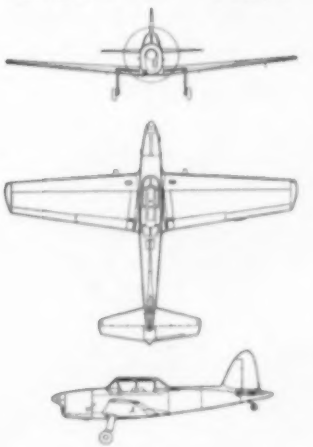
Below and right, T-34A Mentor; bottom and lower right, F-86 Sabre.

Power plant ...	Avro Orenda 14
Span	37ft 1in
Length	37ft 6in
Gross weight	16,000 lb
Max. speed	about 690 m.p.h.

Power plant ...	**R.R. Canada Nene 10**
Span	38ft 10½in
Length	37ft 9in
Gross weight ...	about 12,000 lb
Max. speed	600 m.p.h.



Power plant	**Wright R-1820**
Span	69ft 8in
Length	42ft 3in
Cruising speed ...	150 m.p.h.



Power plant ...	**D.H. Gipsy Major 1c**
Span	34ft 4in
Length	25ft 5in
Gross weight	1,930 lb
Max. speed	139 m.p.h.

increased thrust, reduced weight and improved specific consumption. Accommodation of this engine, 30 per cent more powerful than the original J47, involved major re-designing of the fuselage structure and intake duct. Canadair-built Sabres are in service with the R.C.A.F., R.A.F. and U.S.A.F., as well as with the air forces of France, Turkey and Greece. Unlike Australia's Avon-Sabre the Canadair version retains the standard American fixed armament of six 0.50in guns and can carry 4,000 lb of bombs or rockets externally.

Canadair Silver Star Basically similar to the Lockheed T-33, a two-seat training version of the F-80 Shooting Star, the Canadair T-33AN Silver Star is powered by the Canadian Rolls-Royce Nene and thus offers improved all-round performance. Delivery began late in 1952 and since then some 500 have been built, with production expected to continue for some time. When the cease-fire was sounded in Korea Silver Stars were being built at the rate of two per day. Used by the R.C.A.F. both in Canada and Europe, the T-33AN is the standard jet trainer for pilots of that service and of all Canadian-trained N.A.T.O. pilots.

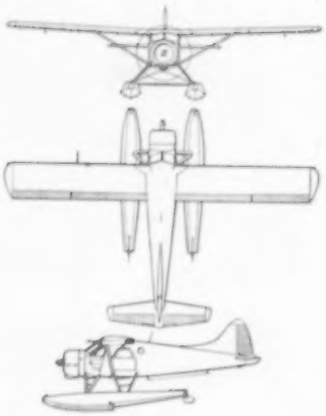
de Havilland CS2F-1 Selected for large scale service with the Royal Canadian Navy, the Grumman CS2F-1 will be assembled and tested by de Havilland Aircraft of Canada at Toronto; this company will also be responsible for building forward fuselages. While de Havilland are thus the "prime contractors," other parts of the aircraft are being widely sub-contracted throughout the Canadian industry.

An initial order for 25 CS2F-1s was announced early last year, though it is reported that the total bought for the R.C.N. now stands at 100 and that N.A.T.O. orders may eventually bring the total to as high as 250. Carrying a crew of four and powered by two Wright Cyclones (Canadian-built), the CS2F-1 is a multi-purpose aircraft with the primary rôle of submarine search and attack. Weapons carried include homing torpedoes, rockets, depth charges and mines, used in conjunction with a miscellany of aids, including radar, electronic counter-measures, magnetic detectors, searchlight and sonobuoys. Endurance is quoted as eight hours and cruising speed as 130 kt. A major factor behind the R.C.N.'s selection of the CS2F-1 was its ability to operate from light fleet carriers without catapult or rocket assistance. Novel features of the aircraft include a hydraulic rudder boost for single-engined flying.

de Havilland Chipmunk Designed and initially developed by de Havilland of Canada, the Chipmunk is undoubtedly one of the most successful of post-war light trainers. Its success is indicated by the fact that in England, where the design was adopted by the parent company, nearly 1,000 were built. Between 1946 and 1951 the Canadian factory produced 158 Chipmunks. A re-order from the R.C.A.F. caused the type to be put back into production and delivery of a batch of 60 began some weeks ago.

Top, T-33 Silver Star.
Centre, CS2F-1.
Bottom, Chipmunk.

Above and right, Beaver.



Power plant ...	Pratt and Whitney R-985
Span	48ft
Length	30ft 4in
Gross weight	4,820 lb
Max. speed	164 m.p.h.

Aircraft of the Commonwealth . . .

de Havilland Beaver So widely known is the Beaver—civil versions are serving in 36 countries—that there is no need to elaborate here on its virtues of strength, simplicity and reliability. We may recall, however, that its rôles include the operation of regular airline services in outback areas (carrying up to eight people), freighting, ambulance work, survey, fire-fighting, power-line patrol and agricultural work. The Beaver can operate from land, water or snow, using wheel, float or ski undercarriages, the latest version having an amphibious undercarriage incorporating standard wheels and brakes. Capable of operating from strips of less than 200 yd length, the Beaver will lift well over half a ton of payload and can cover distances of up to 1,000 miles. Nearly 300 have been delivered to civil operators and the military version has been even more successful; the United States Army and Air Force have taken delivery of over 500 L-20 Beavers and production for America will continue well into 1957.

de Havilland Otter Designed, built and operated in the tradition of the Beaver, the Otter is a larger aircraft, having capacity for up to 14 passengers or over a ton of cargo. Having a single engine (a 600 h.p. Wasp), the Otter tends to be classed with considerably smaller aircraft; in fact, its span exceeds that of the Dove, Prince and Twin Beech. Like the Beaver, the Otter operates from 200 yd strips, and will take distances of 1,000 miles in its stride; stalling speed is only 45 m.p.h. The 345 cu ft cabin is unusually accessible, the largest of the four doors being nearly 4ft square. Float, wheel, ski or wheel-ski undercarriages are optional. Largest Otter customers are the U.S. Army and Navy, who have ordered 102. At the time of writing over 80 had been delivered to military and civil operators.

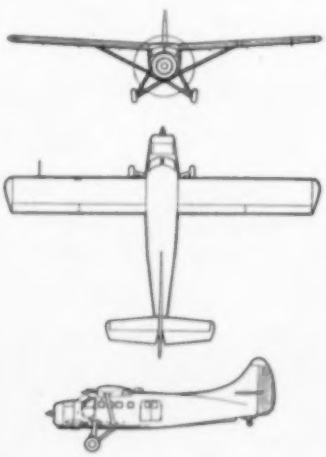
Doman-Fleet LZ-5 Completion of the first Fleet-built LZ-5 recently marked the beginning of a Canadian helicopter industry. This aircraft is one of a batch now being produced in anticipation of a Service order. The first LZ-5s built by Fleet incorporate a number of Doman-made precision components, including rotor blades and assemblies, but it is intended that manufacture of the entire aircraft will eventually be undertaken in the Canadian firm's Fort Erie plant.

Of apparently orthodox layout, the LZ-5 embodies an unconventional hingeless four-blade main-rotor system. Inclination of the top-path plane of the rotor relative to the fuselage is accomplished by gimbal-mounting the rotor hub. Powered by a 400 h.p. air-cooled

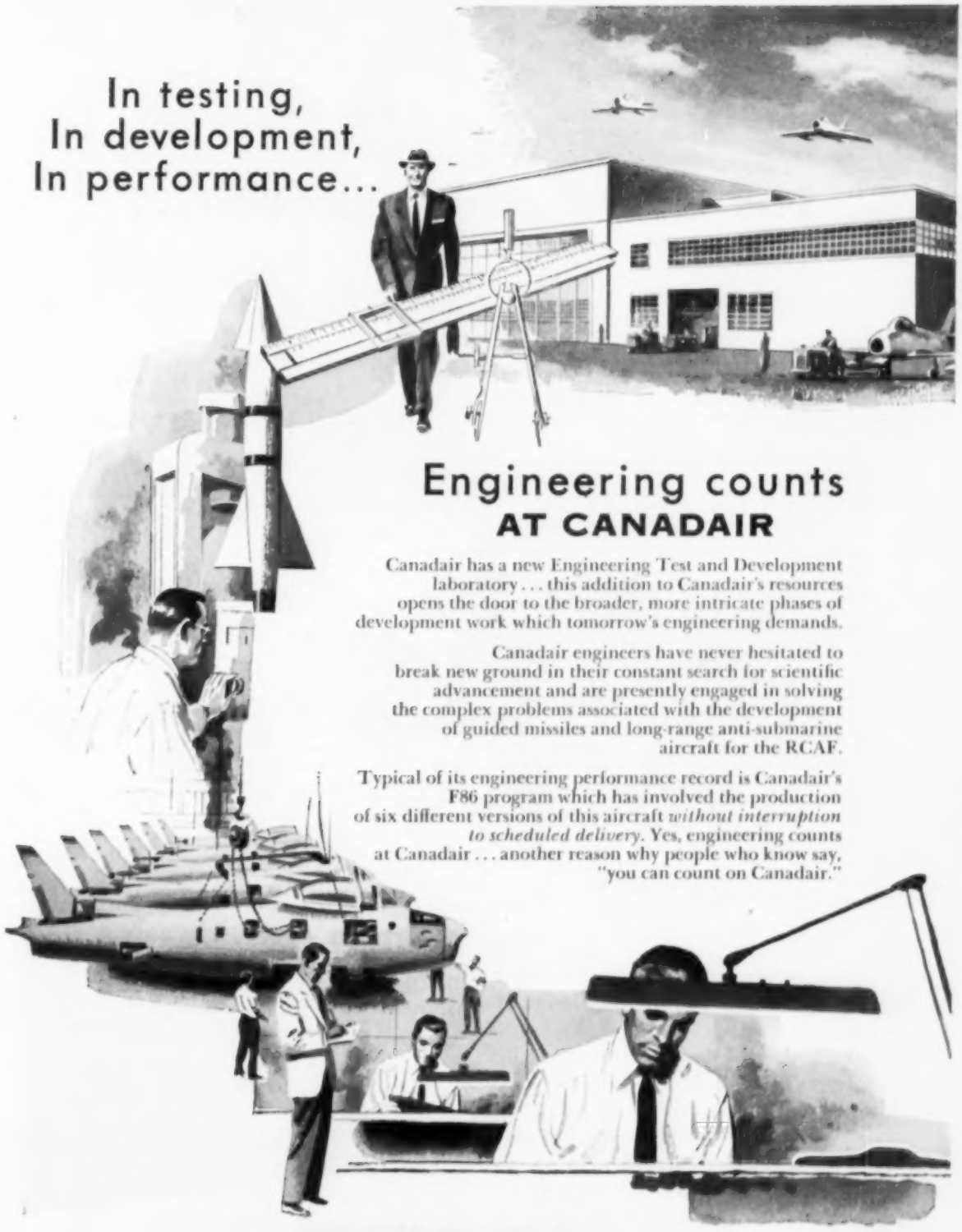
(Continued on page 295)

Below and right, Otter.

Power plant ...	Pratt and Whitney R-1340
Span	58ft
Length	41ft 10in
Gross weight	7,600 lb
Max. speed	160 m.p.h.



In testing,
In development,
In performance...



Engineering counts
AT CANADAIR

Canadair has a new Engineering Test and Development laboratory . . . this addition to Canadair's resources opens the door to the broader, more intricate phases of development work which tomorrow's engineering demands.

Canadair engineers have never hesitated to break new ground in their constant search for scientific advancement and are presently engaged in solving the complex problems associated with the development of guided missiles and long-range anti-submarine aircraft for the RCAF.

Typical of its engineering performance record is Canadair's F86 program which has involved the production of six different versions of this aircraft *without interruption to scheduled delivery*. Yes, engineering counts at Canadair . . . another reason why people who know say, "you can count on Canadair."

C-L CANADAIR
— AIRCRAFT MANUFACTURERS —
LIMITED, MONTREAL, CANADA

European Representative: J. H. Davis, Princes House, 190 Piccadilly, London, W.1., England.

Life line of communication . . .

In 1906 Marconi's carried out their first experiments in ground to air radio. Today more than 40 airlines and 20 airforces fit Marconi equipment and Marconi ground installations are in use throughout the world's airports. The foresight and enterprise that have developed the communications on which elaborate modern aircraft operation relies are still alive. Marconi research today is making possible and safe still further progress.

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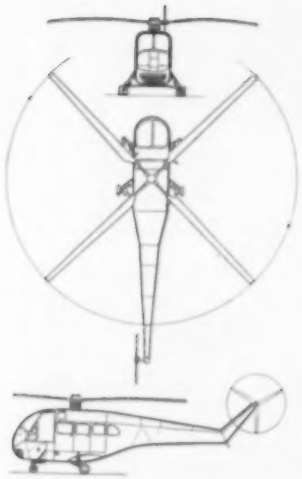
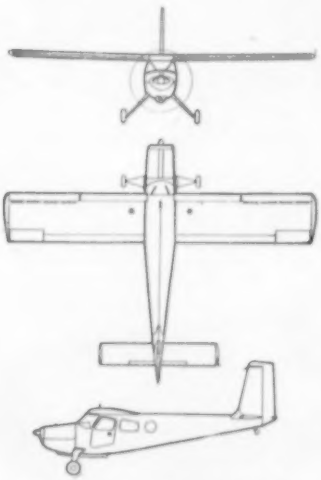


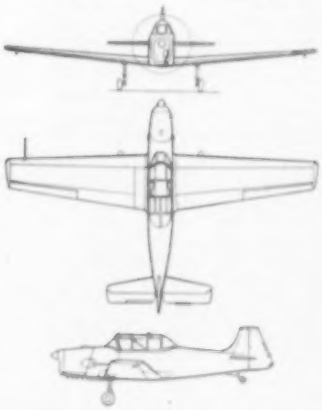
Power plant ...	Lycoming SO-580-D
Rotor diameter	48ft
Length	38ft
Gross weight	5,000 lb
Max. speed	98 m.p.h.



Power plant ...	Lycoming 260 h.p.
Span	39ft
Length	30ft
Gross weight	2,800 lb
Cruising speed ...	157 m.p.h.

INDIA

Power plant ...	Blackburn Cirrus Major III
Span	35ft 2in
Length	25ft 3in
Gross weight	2,240 lb
Max. speed	130 m.p.h.



Above and left, Doman-Fleet LZ-5.

Above and left, Courier.

Aircraft of the Commonwealth . . .

Lycoming, the LZ-5 accommodates a pilot and up to six passengers. The parent Doman company has delivered a number of LZ-5s to the U.S. Army for Service trials. Certification of a civil version is expected within the near future.

Fleet Courier Under an agreement with the American designers of the Helio Courier, Fleet Manufacturing, Ltd., hold all Commonwealth production and sales rights for this aircraft, third of the Helioplane series. In addition Fleet will build components on behalf of the design firm for assembly in the United States.

As its name implies, the Helioplane is designed to combine some of the advantages of helicopters with fixed-wing characteristics. Its sponsors believe that the two greatest obstacles to the spread of private flying are the amount of "technical know-how" to be mastered by the pilot of the average lightplane, and insufficient safety of operation. The Courier, designed to overcome these objections, is claimed to be virtually non-stallable and non-spinnable; with the aid of full-span slots and wide slotted flaps it can be flown under full control at 27 m.p.h. Four occupants are carried in a special "over-strength" cabin designed on the basis of Cornell accident-research findings. The "nosewheel" positioning of the mainwheels makes it virtually impossible to overturn the aircraft on the ground. Construction is all-metal.

Six Fleet-built Couriers have been assembled in Helio's Boston factory, but future Canadian-licensed Couriers will be produced by Fleet at Fort Erie.

Hindustan HT-2 This unpretentious but efficient basic trainer has a place in aviation history, for it is the first aircraft to be both designed and quantity-produced in India. It has been adopted as standard equipment for the I.A.F., and has also been ordered for State-aided flying clubs. Plans are being made for an overseas demonstration tour, and the prospect of orders from other Eastern countries appears bright. Visitors to Bangalore have commented favourably on the HT-2's qualities; Dr. Kurt Tank, the German designer, flew the aircraft himself, commenting favourably on its handling qualities and aerobatic performance.

Powered by a 155 h.p. Cirrus Major III, the HT-2 is of all-metal construction and has a cruising speed of 115 m.p.h. Stalling-speed with 30 deg flap is 47 m.p.h. and the initial rate of climb is 800 ft/min. The HT-2's endurance, on 26 gal, is about 3½ hr. Its designer, Dr. Ghatage, has also completed the design of an advanced trainer, the HT-10, and is working on a projected medium transport.

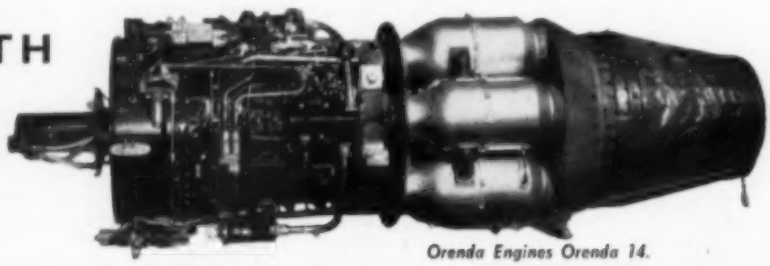
Below and left, HT-2.

AIRCRAFT OF THE COMMONWEALTH — 1955

	Power Unit(s)			Span (ft.)	Length (ft.)	Gross Weight (lb)	Max. Speed (m.p.h.)	Typical Load or Operational Equipment	Remarks
	No.	Type	Total power *						
AUSTRALIA									
D.A.P. Canberra B.20	2	C.A.C. Avon	13,000	64	66	—	—	—	In production.
D.A.P. Jindivik 2	1	A.S.M. Viper	1,900	19	23	—	—	Radio-governed autopilot	In production. High subsonic speed.
CA-22 Winjeel	1	P & W R-985	455	39	29	4,235	187	Three seats, 72 gal. fuel	Deliveries in progress; 62 on order.
CA-27 Sabre	1	C.A.C. Avon 20	8,000	37	38	17,000	700	Two 30 mm. Aden guns plus 4,000 lb stores on underwing racks.	Deliveries in progress. At least 90 on order.
D.H. Vampire T.33	1	D.H. Goblin 3	3,500	38	34	12,390	550	20 mm guns, plus 1,000 lb underwing load.	In production. At least 36 on order.
Fairey Firefly T.5	1	R-R Griffon 74	2,020	41	38	12,000	360	Four 20 mm guns plus underwing stores.	Conversion of British-built Firefly A.S.5. Limited production.
CANADA									
Avro Canada CF-100-4	2	Orenda 11	15,000	50	54	37,000†	660	104 rockets and eight 0.5 guns.	In production.
Avro Canada CF-105	2	Orenda PS-13	40,000†	—	—	50,000†	M = 1.5†	Guided weapons.	Production contract; prototype expected to fly in 1957. Will have delta wing.
Canadair C-4	4	R-R Merlin 720-6	7,040	117	94	82,300	320	About 15,000 lb or 40 seats	72 built, civil version pressurized.
Canadair C-5	4	P & W R-2800	9,000	117	94	86,000	340	About 18,000 lb.	One only. V.I.P. transport.
Canadair Sabre 4	1	J47-GE-27	5,800	37	38	16,000	670	Six 0.5in guns.	Total of 1,350 built. Sabre 6 currently in production.
Canadair Sabre 6	1	Orenda 14	8,000	37	38	16,000	690	Six 0.5in guns. Underwing stores.	
Canadair Silver Star (T-33AN)	1	R-R Nene 10	5,100	36	38	12,000	600	Two 0.5in guns. Dual control.	In production; about 500 delivered.
Canadair CL-27	4	Wright R-3350	14,800	142	122	150,000	350	Various offensive stores internally.	Development of Britannia; 13 reported on order. First flight in 1957.
CanCar Harvard 4	1	P & W R-1340	550	42	30	5,617	210	Two seats.	550 built since 1945, some for U.S.A.F. as T-6G Texan.
CanCar Mentor (Beech T-34A)	1	Continental	225	33	26	2,900	190	Two seats. Radio.	Production of 125 (100 for U.S.A.F., 25 for R.C.A.F.) almost complete.
D.H.C.1 Chipmunk	1	G. Major 1c	140	34	25	1,900	139	Two seats. 742 lb disposable.	Total of 158 built; about 900 more from U.K.
D.H.C.2 Beaver	1	P & W R-985	450	48	30	4,820	164	Up to seven seats.	In production; about 800 delivered.
D.H.C.3 Otter	1	P & W R-1340	600	58	42	7,600	163	Up to 17 seats.	In production; about 80 delivered.
D.H.-built CS2F (Grumman design)	2	Wright R-1820	3,000	70	—	—	—	Four seats, weapons and radar	To be manufactured in Canada, D.H. being "prime contractor."
Fleet-built Courier	1	Lycoming	260	39	30	2,800	157†	900 lb. (agricultural 1,600).	Licence from Helio Aircraft Corp. Agricultural weight 3,800 lb.
Doman-Fleet LZ-5	1	Lycoming SO-580D	400	40‡	38‡	5,000	98	2,140 lb or six passengers.	Licence from Doman Helicopters, Inc.
INDIA									
Hindustan HT-2	1	Cirrus Major III	155	35	25	2,240	130	Two seats. Radio optional.	In production for I.A.F. Available for export.
Hindustan HT-10	1	P & W R-1830	1,050	44	33	8,500	230†	Two seats side-by-side.	Prototype being built.

* Pounds thrust or horsepower; † Estimated value; ‡ Rotor diameter and fuselage length.

COMMONWEALTH ENGINES 1955



Orenda Engines Orenda 14.

AMONG the engines manufactured in the Commonwealth countries and referred to in the following pages, three are of indigenous design, the Commonwealth Aircraft Cicada and the Orenda Engines Orenda and PS-13. Originally intended for the Winjeel, the Cicada has been wholly designed, manufactured and developed by the Australian Commonwealth Aircraft Corporation. Production has been suspended on this engine, which is a seven-cylinder air-cooled radial weighing 770 lb, of 46.5 in diameter and 58 in length, and developing 450 h.p. at 2,600 r.p.m. at sea level.

Two twin-stage-turbine models of the Orenda series of turbojets are currently in production, the Orenda 11 (Avro CF-100) and the Orenda 14 (Canadair Sabre 6). More than 2,500 engines have been built by the Orenda company (previously the gas turbine division of A. V. Roe Canada) since its production plant was officially opened in September 1952. Since that time thrust ratings have increased from 5,800 lb (Orenda 2) to over 7,000 lb (Orenda 11 and 14), and current costs are now averaging only $8 per pound of thrust.

Modifications introduced during the past year on Orenda engines are described on page 300. The Mark 11 and 14 Orendas each possess a ten-stage axial compressor and six combustion chambers, as do the earlier versions fitted with single-stage turbines. The Mark 14 incorporates electronic exhaust-temperature control.

Magnesium alloy is used for the air intake and compressor casings. The compressor comprises three light-alloy drums bolted together, with one steel disc at the upstream end, all the blading being of light alloy apart from the last stage which is steel. The combustion chambers employ Duplex downstream burners, there being a twin-manifold fuel supply fed by a Lucas pump at 1,500 lb/sq in. Bendix supply the full-range flow control unit. All Orendas are at present started electrically (the Jack and Heintz starter being prominent in the photograph). This motor is faired by a spinner which, in Orendas for the CF-100, terminates in a nose-cap bearing a pair of vanes. These vanes are spun round by ram air and each incorporates an alcohol spray for de-icing purposes.

No official information has been released concerning the PS-13, or Super-Orenda, the two spool turbojet which, it is hoped, will eventually power the Avro CF-105. American and Canadian reports, however, have quoted a design rating of 18,000 lb thrust —25,000 lb with afterburner—and a titanium content of 20 per cent by weight.

It is no mean task to develop an engine of the calibre of the PS-13, and Orenda Engines—together with the Hawker Siddeley Group and the Canadian Government—are to be congratulated for having taken so bold a step. Earlier this year the president of the company stated that Orenda had then spent four million dollars in the development of the new engine, and the general tempo of PS-13 work is accelerating continuously. Today it is likely that component running has begun—in fact, it has even been unofficially reported that the engine is already running as a unit. Canada may, therefore, have the most powerful engine in the world.

Avro Aircraft CF-100s at Malton, Toronto.

THE CANADIAN INDUSTRY

IN the wide miscellany that is Canada's aeronautical scene today there are many contrasts. Traffic jams outside Avro's plant at Malton; the calm wide expanse of Thunder Bay and CanCar's Fort William; the new west-coast plants with paint hardly dry. The fresh salt air at Eastern Passage, Nova Scotia, where Fairey serves the Navy; the other Fleet at Fort Erie, Ontario, where even the race-track chooses to airmark itself by a blimp overhead. And, of course, Montreal, with its huge glass beehive built around aviation—the International Aviation Building—complete with aloof and air-conditioned atmosphere.

In the air-conditioned factories, too, there are varied projects, problems, plans, and programmes. Here is expansion, here a manpower surplus following the quite widespread "stretch-out" after the fever of Korean-time production. For the production peaks of the Korean period are still casting shadows over Canadian aviation. But, expansion or "stretch-out," there is invariably a vigorous, flexible approach to the problems ahead. It is a challenging and a satisfying time to be in Canada, and in aviation.

Much of the story of the building up of Canada's aircraft industry in the postwar years is, in effect, the story of the remarkable Mr. C. D. Howe, Minister of Trade and Commerce and Minister of Defence Production. The Government plan which he sponsored called for the development of a self-sufficient aircraft industry for Canada, with a particular emphasis on the cultivation of a large and capable ancillary industry, with accessible sources of supply, to provide the major firms with materials, components and equipment. Dependence on outside countries for continued production was to be eliminated.

At the present time, this desirable state of affairs has been largely achieved, and the new balanced pattern of industry is emerging. As in Britain, however, most firms in Canada are still almost wholly dependent on Government orders, although progress towards reducing this dependence is being achieved.

Slightly fewer than 40,000 people are employed at present in some 45 factories in Canada. The seven main airframe and engine companies now have some 7,500,000 sq ft of plant space, while the subcontractors, equipment manufacturers and repair and overhaul organizations add another 3,500,000 sq ft to the total.

In marked contrast to the operating side of Canadian aviation, which is enjoying an unprecedented boom in air freighting in connection with the northern radar chains, the manufacturing industry in general is at present stretching out its production programmes. Following the extremely high production rates of the last few years, and a revision in political thinking after the beginning of Korean truce talks (the new U.S. administration cancelled a $100m order placed in Canada for T-36 twin-engined trainers), firms have been told to slow down the pace somewhat—to remain alert and tooled up, but to spread deliveries over a longer period.

And yet there is expansion, too, in Canada's aeronautical life. Over the past year, this has been noticeable in three directions. Firstly, a number of firms have decided to expand their research and development facilities, in order to widen the base of their work and to support more effectively their production units. Secondly, groups such as Hawker Siddeley and Bristol have streamlined their organizations and have concentrated much of their expansion effort in building up the newer subsidiaries (e.g. Canadian Steel Improvement and MacDonald respectively) and, in the case of Hawker Siddeley, acquiring a further substantial interest (in Canadian Car and Foundry). Thirdly, there is the expansion of the design sections of major ancillary firms.

Work in the field of guided weapons has been intensified during the past year, and test firings of Canada's Velvet Glove air-to-air missile have been made from an F-86E Sabre. Avro, de Havillands, and Canadair are among those active in this work: the possible future production in Canada of certain British and American missiles has also been reported.

A significant current example of extensive subcontracting is seen in the important R.C.N. contract for 100 Grumman CS2F-1 anti-submarine aircraft to be built in Canada under licence by de Havillands at Downsview. De Havillands, as prime contractor, are manufacturing only the front fuselage, and are undertaking the final assembly and installation and equipment. Canadian Pratt and Whitney, prime contractors for the engines, will build the Wright R-1820 Cyclones under licence, while the remaining airframe units have been subcontracted by de Havillands to seven other companies.

Two Canadian Service requirements which should lead to further industry contracts in the near future are those for a Naval helicopter and for a jet trainer for the R.C.A.F. Several Canadian firms have eligible contenders in one or both categories.

In the 1954 Commonwealth issue of *Flight*, we described in full the facilities, work and historical background of the Canadian aircraft companies. Our aim this year is to report on developments during the past 12 months and to describe current activities. In the case of 22 of the main aircraft and ancillary companies, the accounts follow visits made by Kenneth Owen of *Flight's* editorial staff during a 12,000-mile tour of the Canadian industry. Also included this year are brief descriptions of two significant organizations on the Canadian scene (the Air Industries and Transport Association and the recently formed Canadian Aeronautical Institute, which cater respectively for the companies and the technical men they employ); and an enlarged Canadian section of the Commonwealth directory.

The Canadian Industry . . .

CANADIAN AERONAUTICAL INSTITUTE

FORMED in the Spring of 1954 to provide a Canadian counterpart to the Royal Aeronautical Society and the Institute of Aeronautical Sciences, the Canadian Aeronautical Institute has experienced a year of rapid growth. It has increasingly assumed the responsibility which a technical society should fulfil in Canadian aviation, with the essential support of vigorous branch organizations. At the second annual meeting in May this year, the total membership reported was over 1,100—an increase of more than 700 since the first meeting last year.

In the early stages the new Canadian society received encouragement and technical and financial assistance from both the R.Ae.S. and the I.A.S. Initially the C.A.I. possessed three branches (in Ottawa, Toronto and Montreal) and set up its headquarters with a small permanent staff in Ottawa. During the last year new branches were established in Vancouver and Winnipeg, and it is expected that further branches will soon be formed in Edmonton, Calgary and Halifax, where interim organizations already exist.

In addition to well-attended meetings held monthly by the various branches throughout the winter season, the Institute organized a major two-day meeting, in conjunction with the I.A.S., in Montreal last October. The programme of this year's annual general meeting was extended to include four technical sessions (concerned with education and training, manufacturing, aerodynamics and operations), in addition to the business meetings and annual dinner. The 1954 McCurdy Award for the most outstanding Canadian aeronautical achievement of the year was made by the Hon. J. A. D. McCurdy to Mr. M. W. MacLeod of T.C.A. on the occasion of the dinner, at which the principal speaker was Dr. T. P. Wright, of Cornell University.

In April this year the original *C.A.I. Log*, which had been produced monthly by the offset process, was superseded by the *Canadian Aeronautical Journal*, which has proved to be an enterprising and extremely well-produced publication.

The major portion of financial support for the C.A.I. has come from some 50 companies in the aircraft industry which are registered as "sustaining members" of the Institute. Individual membership is classified into the grades of Fellow, Associate Fellow, Member, Technical Member, Technician, Student and Associate.

On the formation of the C.A.I., office space and secretarial help were initially provided by the Air Industries and Transport Association at its Ottawa headquarters; the Institute is now established in its own headquarters at 304, Laurier Avenue West, Ottawa 4, where the permanent staff is headed by the secretary, H. C. Luttman. At the recent second annual meeting R. D. Richmond of Canadair took over as president of the Institute from Dr. J. J. Green.

In its planning for the future the C.A.I. is launching a major project to study the education and training of technical aeronautical personnel at all levels. This is a long-term plan and the eventual hope is for the submission of recommendations to industry and to educational authorities for alleviating the critical shortage of trained manpower which is evident in Canada at the present time. The C.A.I. is beginning to provide an extremely useful medium for the exchange of aeronautical information, both domestically and—through its connections with the R.Ae.S. and I.A.S.—in the international sphere. Its growth and achievements to date can be directly attributed to the energy and confidence of its members, and the Institute's future is indeed promising.

Mr. R. D. Richmond, of Canadair, President of the Canadian Aeronautical Institute.

AIR INDUSTRIES AND TRANSPORT ASSOCIATION

NOW in its 21st year, the Air Industries and Transport Association of Canada represents the interests of the aviation industry. As its title implies, operators as well as manufacturers are included in its membership—the main point of difference between the A.I.T.A. and Britain's S.B.A.C. At the time of the Association's formation in 1934, it was the aim of the founders to give coherence to the voice of Canadian aviation and to establish a foundation upon which a stable and rational aviation industry could flourish; the first of the stated objectives of the A.I.T.A. is "to foster, encourage and stimulate in Canada the development of commercial aviation in all its branches."

At last year's annual meeting of the Association it was reported that membership had increased steadily over the past six years from 95 to 190. Under the president and Board of directors the Association's main work has been divided broadly along two lines, through ten-member councils responsible for transport and industrial affairs respectively. Specialized committees report to each council. On the transport side these study problems of helicopters, aviation, training, aerial spraying, and search and rescue; while industrial committees comprise those devoted to finance, contracts, co-ordination of standards, and technical aspects. A further group of four general committees is engaged in fostering aviation information, advising the Association on financing problems, studying customs tariff and excise legislation, and advising members on legal and insurance problems.

During the last year a new telecommunications committee has been set up; the standards co-ordination committee has been increasingly active; and there has been a gradual building-up of technical activities in general. The Association has been instrumental in obtaining substantial downward revisions in the tariffs on a number of aircraft items not made in Canada (a comprehensive brief had been prepared and presented to the Government by the A.I.T.A. customs tariff committee, and the changes came into effect with the most recent budget).

On the operating side, A.I.T.A. has been active in obtaining large-scale participation for its members in the airlift of materials for northern defence construction projects. Construction work on the two early-warning radar chains, the DEW line and the Mid-Canada line, has made such demands on air transport capacity that Canadian operators have undertaken extensive re-equipment and have been carrying out an unprecedented amount of arctic flying. Co-ordination of the Canadian carriers' efforts on these projects has been effected largely through the Association.

As a sideline, the Association found itself in the helicopter business for a few days last autumn, when it operated Canada's first urban helicopter passenger service during its annual meeting in Quebec City. With helicopters provided by the R.C.A.F., R.C.N. and the Bell company, a total of 463 passengers were flown between the airport and a specially licensed down-town heliport in the three-day operation. This activity was symbolic of one important aspect of the Association's future planning, for the field of helicopter regulation—although in an early stage of development at present—is one which is rapidly growing in importance.

The president of A.I.T.A. is T. P. Fox (Associated Airways, Ltd.); B. W. Pittfield and R. W. Ryan are vice-presidents. Of the Association's headquarters staff at 86 Wellington Street, Ottawa 4, R. N. Redmayne is general manager, A. C. Morrison is secretary and R. B. Ferris is information officer.

Production at Avro Aircraft's Malton plant: CF-100s on the line.

A. V. ROE CANADA, LTD.

UNDER the new organization announced last December, A. V. Roe Canada is now the parent company of three wholly owned operating subsidiaries: Avro Aircraft, Ltd., Orenda Engines, Ltd., and Canadian Steel Improvement, Ltd. The first two of these companies were formed from the Aircraft Division and the Gas Turbine Division respectively of the parent company, while C.S.I. had been purchased by the Hawker Siddeley Group in April of last year.

At the time of the announcement of the revised organization, Crawford Gordon, Jr., president of A. V. Roe Canada, stressed that each unit of the new group would be completely independent of the others in developing its own products and customers, while at the same time enjoying the benefits of group association. The formation of the three-company group, he said, was a logical conclusion to a decentralizing programme which had been proceeding for some time.

Describing the progress of A. V. Roe Canada from its beginnings in 1945, when the Hawker Siddeley Group purchased the Crown-owned assets of Victory Aircraft, Mr. Gordon said that the parent group had since made a total permanent investment in Canada of more than $16m. When the company began operating, it had some 300 employees; the three companies of the new group now employed a total of 16,000. Manufacturing and engineering space, which in 1945 totalled one million square feet, was now approaching three million, of which 2½m was concentrated at Malton.

A significant additional investment by the Hawker Siddeley Group, through A. V. Roe Canada, was implied in the recent offer (reported to be over $20m) for the issued shares of Canadian Car and Foundry, Ltd., of Fort William. The Board of CanCar have recommended the acceptance by shareholders of the offer.

Details of the facilities and activities of the operating companies are given separately under their respective headings. Chairman of A. V. Roe Canada is Sir Roy Dobson; Crawford Gordon, Jr., is president and general manager (and also chairman and president of Avro Aircraft and Orenda Engines); Air Marshal W. A. Curtis is vice-chairman and H. W. Aitcheson is group secretary.

Avro Aircraft, Ltd. An exception to the "stretch-out" tendency apparent in many sections of the Canadian aircraft industry is the $5m expansion programme being carried out by Avro Aircraft in connection with the introduction of the CF-105 supersonic delta. This work includes the provision of additional buildings; hangar, laboratory and office space; and new presses and machines. A new group has been set up, within the engineering division, to carry out research and development on guided missiles and weapons systems; and four R.C.A.F. squadrons of CF-100 all-weather fighters are expected to be serving in Europe next year. These are three significant Avro trends apparent over the past twelve months.

As with the two other constituent firms in the A. V. Roe Canada group, the beginning of 1955 marked the start of this latest chapter in the aircraft firm's development. The aircraft division of A. V. Roe Canada became Avro Aircraft, Ltd., a separate company. This company, with some 8,000 employees occupying 1,500,000 sq ft at Malton Airport, Toronto, is now one of Canada's largest employers in the aircraft industry, just ten years after the original A. V. Roe Canada company was formed with a staff of only 300.

Avro's outstanding achievement has, of course, related to the CF-100, the first military intercepter aircraft to be designed and built in Canada. At the end of 1954, production on the rocket-firing Mark 4 was running at a peak rate of one per day: this has since been cut back to 10-12 per month. During the past year, the CF-100s have appeared outside Canada for the first time, in the U.S.A., England (for evaluation by the Central Fighter Establishment), and at the Paris Aero Show and, as mentioned briefly already, more are to be based in Europe. Following the complete equipment later this year of regular air-defence squadrons in Canada with the CF-100, four of the 12 R.C.A.F. squadrons in Europe are to exchange their Sabre day-fighters for the Avro all-weather machines during 1956, thus strengthening NATO all-weather defences.

Well over 300 of the current order for 510 CF-100 Mark 4s have been produced, and most of the earlier 70 gun-firing Mark 3s are being converted to trainer versions. An improvement in altitude performance has been obtained with the removal of the fuselage rocket-pack, and further improvement is expected in the near future from the addition of wingtip extensions, the manufacture of which is to be subcontracted. Other recent modifications to the CF-100 have been concerned with R.C.A.F. radar/weapons requirements.

Tooling and component manufacture is well under way at Malton for the huge delta CF-105, a number of which have been ordered by the Government. New production methods, implying less delay between prototype and series production, have been devised, and the first machine should be completed early in 1957. Two Orenda PS-13s would seem a natural choice of powerplant for the CF-105, although a proven type such as the Pratt and Whitney J75 may well be used for the first aircraft.

New buildings recently completed, or still under construction, at Malton cover an area of 150,000 sq ft, including an additional 50,000 sq ft of flight-test hangar space. Among the more impressive equipment being installed for the CF-105 programme are a large skin mill and a new 15,000-ton hydraulic rubber press, scheduled for delivery this summer. Heavy forgings and steel members for the press are being built by Siempel Kamp, Germany; electrical equipment is being made in Canada; and the hydraulic pumps in the U.K.

Although the company has no comment to make on Project

Crawford Gordon, Jr. (left), president and general manager of A. V. Roe Canada; and F. T. Smye, vice-president and general manager of Avro Aircraft.

W. R. McLachlan (left), vice-president and general manager of Orenda Engines; and C. J. Luby, president and general manager of Canadian Steel Improvement.

The Canadian Industry . . .

"Y," their much-publicized "saucer" design, except to mention that the special projects department is still in existence, Canadian press reports early this year referred to U.S.A.F. interest in this project, on which (it was stated) the Canadian Government had spent $4-5m before abandoning it. A major setback in March of this year was the fire which burned down Malton's Hangar 5, rented by Avro Aircraft and Orenda Engines for test development and special manufacturing work. The loss, excluding the value of the hangar, which belonged to the Department of Transport, was estimated at some $5m.

Under Crawford Gordon, Jr. (chairman and president), F. T. Smye (vice-president and general manager) is the executive head of Avro Aircraft. Other senior officials include J. C. Floyd, vice-president, engineering; H. R. Smith, vice-president, manufacturing; J. A. Morley, vice-president, sales and service; J. Turner, secretary and treasurer; and D. H. Rogers, chief test pilot.

Orenda Engines, Ltd. Successor to the Gas Turbine Division of A. V. Roe Canada, Orenda Engines began operations as an autonomous company in the A. V. Roe Canada group on January 1st of this year. Its facilities comprise a modern production plant of 750,000 sq ft, completely air-conditioned, near Malton Airport, Toronto, plus a design department, research and development laboratories, full-scale test establishment at Nobel, Ontario (160 miles north of Toronto), and flight test establishment. Approximately 6,000 people are employed, of whom some 25 per cent are engaged on research and development.

More than 2,500 engines have been built by Orenda since the opening of the Malton production plant in September, 1952. Two models of the Orenda series are currently in production; the Orenda 11 for the Avro Aircraft CF-100, and also the Orenda 14 for the Canadair Sabre 6. Thrust ratings have increased to over 7,000 lb from the original 5,800 lb of the Orenda 2, while weight has been reduced to 2,400 from 2,700 lb, despite the additional weight of a second turbine stage. The demand for strategic materials has been reduced by some 40 per cent.

A measure of the importance of the Orenda programme to the supporting industries can be obtained from the fact that, while 90 per cent of components and materials had to be obtained originally from sources outside Canada, the Canadian content is now up to 95 per cent.

During the last 12 months, production schedules have been maintained, in spite of the introduction of new models and manufacturing techniques and the establishment of a blade shop in the production plant (replacing the sub-contract arrangements for the supply of blades at the end of last year). Modifications incorporated in Orenda engines during this period include the introduction of a nozzle box fabricated of sheet metal, rings and small castings, in place of the original machined casting. A combustion-chamber casing of mild steel with silicone lacquer coating has replaced front-section aluminium castings and the mild steel aluminium-sprayed rear casing previously used, thereby eliminating temperature limits and offering better corrosion resistance. A new exhaust-cone design, in which all spot-welded stiffeners have been eliminated from the casing, is lighter than the original type (employing supported vanes and bullet supported by cross-tubes within the casing), and has resulted in an increase in life. The bullet is now fabricated from three large pressings with integral stiffening beads welded together with integral support vanes.

Among the new manufacturing techniques introduced during the past year is the use of high-speed broaching, which permits a broach speed of 35ft per min on turbine discs, one complete disc being serrated in approximately 50 min. The use of extruded raw material has replaced pot forgings and castings, from which were previously machined outer support-rings, second-stage turbine stator segments and certain stator-blade rings. In the case of compressor stator-blade rings, material is extruded to the exact dimensions, requiring only blade-slots to be machined and a small amount of drilling to be carried out. High temperature brazing, another new development, has made possible the use of stainless steel fabrications in the place of castings and forgings. A considerable increase in cutting-tool life and in cutting speeds has been made possible by employing "mist cooling" (an atomized and combined lubricant and coolant delivered under pressure to the tool-point), in addition to a better surface-finish.

The new Sopwith laboratory, completed early this year, comprises mechanical, materials, instrument, areodynamic and fuel-system laboratories, and covers 31,000 sq ft of floor space. A new building of just under 60,000 sq ft is due for completion this autumn and will house sales and service departments concerned with receiving and storage; offices; and a service training school. Two repair and overhaul shops have been established under sub-contract by the Orenda company during the year: one at de Havilland's Downsview plant (handling, together with Orenda's Malton shop, domestic repair and overhaul); and one at Brockworth Engineering, England, handling engines in European service.

The most interesting current project at Orenda is undoubtedly the PS-13, or "Super-Orenda," and it is unfortunate that Service security restrictions prevent the company from releasing any details at all of this, the ultimate successor to the Orenda engine. At the beginning of this year Mr. Crawford Gordon, Jr., disclosed that the company had already spent $4m on this new turbojet project, "which will be unique in its utilization of titanium." An American source has quoted a design rating of 18,000 lb thrust for the dual-compressor PS-13, and an expectation of 25,000 lb thrust with afterburner.

The operating head of Orenda Engines is W. R. McLachlan, who is vice-president and general manager. The senior management includes also C. A. Grinyer (vice-president, engineering, and chief engineer); E. K. Brownridge (vice-president, manufacturing); F. L. Trethewey (vice-president, sales and service); P. Y. Davoud (sales manager) and K. R. Church (secretary and treasurer).

Canadian Steel Improvement, Ltd. Of all the expansion projects in the Canadian Industry during the past year, none is more striking than that of Canadian Steel Improvement, the third company in the A. V. Roe Canada group. The company started operations in 1951 as a Crown-assisted plant to forge the compressor and turbine blades for the Orenda, since when several million blades have been produced to extremely close tolerances and surface-finish requirements.

In 1954 all the buildings and most of the equipment were purchased from the Government and, following the incorporation of the company into the A. V. Roe Canada group, a team of specialists from High Duty Alloys went out to Etobicoke, Toronto, early this year in preparation for an intensive expansion of the C.S.I. facilities. At that time a wide range of experience had already been gained in close-tolerance forging of aluminium, titanium, steel and high-temperature alloys. In addition to drop- and press-forging facilities, the company possessed a competent engineering and design department, a well-equipped testing laboratory, a full inspection organization and a die-sinking shop.

The recent expansion began last year, when operation commenced in a pilot aluminium sand-casting foundry and precision foundry for investment casting prototype work. A completely new laboratory was next brought into use, fully equipped for mechanical testing, all types of metallographic examination and chemical analysis, and containing full X-ray facilities.

Considerably extended engineering facilities, and an extension to the present die shop, then made possible the production of a wider range of precision forging dies.

By the end of this year, a new forging bay, covering an area of 12,000 sq ft, will be in operation for the manufacture of large aluminium forgings. This will contain drop hammers up to a capacity of 10 tons, plus a wide range of air-operated hammers for hand forging, and additional forging press equipment up to a capacity of 2,000 tons. A complete new production foundry (including pattern shop) of 75,000 sq ft, will also be in use by the end of this year. Sand castings in aluminium and magnesium, and pressure die castings and permanent mould castings in aluminium, will be produced, and complete melting facilities for aluminium will be provided. These extensions will more than double the area of the plant, increasing the floor space by 115,000 sq ft to a total of 176,000.

The president and general manager of C.S.I. is C. J. Luby; other senior officials include J. A. Wellings, vice-president; I. A. Usher, chief engineer; J. G. Gill, plant superintendent, and F. McAlpine, secretary-treasurer.

Bristol executives: (seated) B. A. Chalmers, A.V-M. A. L. James, R. J. Reynolds, W. S. Haggett, J. H. Holt; (standing) E. Burns, V. V. R. Symonds, C. D. Davidson, E. J. Foley, K. L. Marshall, R. H. May.

THE BRISTOL AEROPLANE COMPANY OF CANADA, LTD., AND ASSOCIATED COMPANIES

MOST significant trend in Bristol's Canadian activities during the last twelve months has been the development and expansion of the facilities of MacDonald Bros. Aircraft, Ltd., which were acquired just over a year ago. The current interests of the Bristol organization in Canada may best be described under the separate headings of the respective companies.

The Bristol Aeroplane Company of Canada, Ltd., is the holding company for the various units of the Bristol group in Canada, and is situated in Montreal. It acts as an information and sales centre concerning the technical resources and aviation products of the British parent company, and sponsored a Canadian demonstration tour by a Bristol Sycamore helicopter this summer. This aircraft, purchased by MacDonald Aircraft, operated into and out of the International Trade Fair at Toronto in July, and has since been chartered by Okanagan Helicopters. Sir Reginald Verdon Smith (who is chairman of each of the remaining three companies) is president, and R. J. Reynolds is executive vice-president.

Bristol Aero Engines, Ltd., has as its home a modern, well-laid-out plant built in North Montreal in 1952. Here is undertaken the servicing and overhaul of Bristol Centaurus and Hercules engines and Wright Whirlwinds; Cyclone R-1820s, R-2600s and R-3350s; the overhaul of Rolls-Royce Merlins; and the overhaul and limited manufacture of Lancaster and North Star powerplant components. During 1954 a double-cell test house, adjacent to the plant, was officially opened: it can accommodate piston-engines up to 5,000 h.p. and can be converted to handle turboprops. President of Bristol Aero Engines is R. J. Reynolds; vice-president (engineering) and general manager is A. V-M. A. L. James; and L. W. Smith is works manager.

Bristol Aero Engines (Western), Ltd., located at Vancouver Airport, carries out the overhaul of Pratt and Whitney and Wright engines for the R.C.A.F. and for civil aircraft, together with the repair of airscrews, carburettors and fuel-injection systems for the R.C.A.F., R.C.N. and civilian operators.

The chairman and president of Bristol Aero Engines also hold these same respective appointments with the Western company, of which J. H. Holt is vice-president and J. McCracken superintendent.

MacDonald Bros. Aircraft, Ltd., of Stevenson Field, Winnipeg, have a 25-year record of aircraft manufacture and overhaul which began with the production of Edo floats for the aircraft flown by bush pilots from the Red River seaplane base at Winnipeg in 1930. In the period between the end of the war and the purchase of the company by Bristol last year, MacDonald Bros. began by repairing, overhauling and modifying many wartime types of aircraft for the R.C.A.F., and continued the manufacture of Edo floats and also (as a major contribution towards overheads) of agricultural equipment. In connection with the development of the Orenda turbojet, precision manufacture of a variety of components for this engine was carried out, and became one of the company's major activities.

In parallel with this manufacturing programme, the major modification of Mustangs and Expeditors for the R.C.A.F. provided a programme of aircraft sheet-metal work which has employed a high proportion of the labour force for several years.

In July last year, the shares of the MacDonald company were purchased by the Bristol Aeroplane Company, and since then a remarkable expansion and "streamlining" of facilities and work has taken place. One can visualize that a self-sufficient organization capable of manufacturing complete aircraft is the eventual goal of the Canadian Bristol group, and it is on the MacDonald plant that the group's future airframe manufacture, at least, will be concentrated.

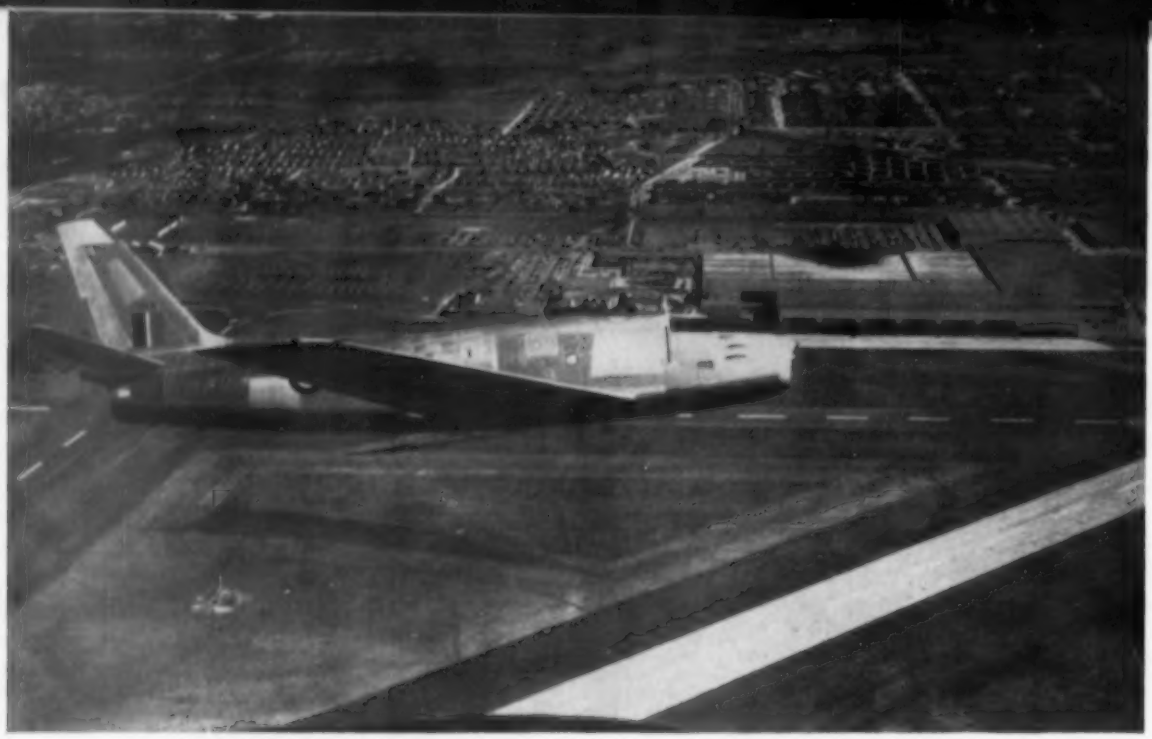
The 250,000 sq ft area in operation when Bristol acquired the plant has been increased to 350,000 sq ft over the past year. This has resulted from the purchase and equipping of No. 2 Plant, which has been in operation over the past four months only. Hufford stretch-presses and other large machines have been installed, in order to build up the potential for aircraft manufacture. Agricultural equipment is no longer produced, and certain distributing rights for aviation supplies have recently been sold to Field. One main purpose in the expansion and rearrangement of facilities has been to segregate the sheet-metal processes and the aircraft work.

New projects began during the past year include, on the overhaul and modification side, a contract to modify 50 Avro CF-100s Mark 3s to trainer versions, and another for the light-bomber conversion (from various versions) of R.C.A.F. auxiliary squadrons' B-25 Mitchells. On the manufacturing side, the company's tooling is well advanced for the sub-contracted production of Grumman CS2F-1 engine nacelles and other components. The greatest manufacturing activity at present concerns the welded stainless-steel components produced under sub-contract for the Orenda, while the manufacture of floats (including amphibious floats) continues for de Havillands (Beaver and Otter) and Cessna (Cessna 180).

At present the company acts as sales agents for the products of the parent company. The future manufacture of British helicopters at Winnipeg, however—provided the Canadian demand (service or civilian) is sufficient—is envisaged. Approximately 1,100 people are employed by the company.

Sir Reginald Verdon Smith and R. J. Reynolds are chairman and president, respectively, of MacDonald Bros. Aircraft. Vice-president and general manager in charge at Winnipeg is W. S. Haggett.

MacDonald Bros. Aircraft plant at Stevenson Field, Winnipeg.



Canadian-built and Canadian-powered: a Canadair Sabre 5 over the company's Cartierville plant.

The Canadian Industry . . .

CANADAIR, LTD.

A SUCCESSOR in 1942 to the Canadian Vickers company, Canadair, Ltd., passed from Government ownership to that of the Electric Boat Company of New York in 1947, and is now a subsidiary company of the American General Dynamics Corporation. Other companies in this powerful American group, chaired by Mr. John Jay Hopkins, are the Electric Boat Company, Consolidated-Vultee Aircraft Corporation, and Stromberg Carlson. Over the past year, Canadair's main development effort has been concentrated on the CL-28 maritime reconnaissance version of the Bristol Britannia, while Sabre and Silver Star production has continued and additional production—of rear fuselages for the Grumman CS2F-1—has begun.

Canadair's facilities at Cartierville Airport, Montreal, now occupy 2,500,000 sq ft of covered area. In Plant 1, the largest, the assembly line for the CL-28 is being laid down, and it is here that the main machine and press shops are located. Plant 2, formerly belonging to Norduyn Aviation, houses the Sabre and T-33 assembly lines, and a number of activities eventually to be moved to the new tooling block. The remaining unit, Plant 4 (Plant 3 is now defunct) is used for repair, overhaul and maintenance work, and also research and development work on the "Velvet Glove" air-to-air missile project.

Over 1,300 Sabres have been built by Canadair, the most recent 200 of which have been the Mark 6 version fitted with Orenda 14s. As a result of scientific production-planning, the 1,000th Sabre required only 0.6 of the man-hours needed for the first production machine. The rate of production has now been cut back from two to one per day, with approximately 200 more of these machines to be produced. Most of these will incorporate a revised leading-edge which will be in effect a combination of the slatted and "solid" types.

Wheel-retraction and other checks being carried out on a Sabre 6 at Cartierville, where more than 1,300 Sabres have been produced.

With 500 of an order for 575 T-33 Silver Stars completed, the T-33 programme is at present tailing off. About five per month will be produced for the next 15 months (compared with a peak rate of two per day). No Government decision has yet been made concerning successors to the Sabre and the T-33, although the reported chances of the North American F-100 Super Sabre, the Convair F-102 and the Lockheed F-104 in the former class have waxed and waned continually over the past year.

The need to reduce personnel numbers drastically during the present "cut-back" period, before the CL-28 programme of production gets under way, has been avoided by the sub-contract from de Havilland for the manufacture of at least 100 complete rear fuselages for the Grumman CS2F-1. The first of these units has already been completed. The present number of people employed at Canadair is approximately 8,000.

The initial R.C.A.F. order for the CL-28 is for 13 machines, the first of which should be delivered during 1957, with an expected increase of the order to 50. Compared with the original Bristol Britannia, Canadair's maritime reconnaissance version incorporates a high proportion of new or substantially modified features, particularly in the lengthened unpressurized fuselage. Unchanged, except for U.S. standardization, are the wings, tail unit, landing gear and flight controls.

The wooden mock-up of the CL-28 has been completed and has been approved by the R.C.A.F. Tooling is well advanced, and manufacture of wing skin panels, wing spar caps, inner-wing spar-webs and other components has begun. It has been reported that, since the start of work in April 1954, it is taking some 400 engineers 18 months to get the new machine—Canada's largest—"into the plant." Three months were spent in preparing for the project and another nine months in "Americanizing" all wing and tail-surface structural drawings. The whole aircraft is to be built by Canadair with the exception of the undercarriage (Jarry Hydraulics, Montreal) and the Wright Turbo-Compound engines.

Although the licence agreement with Bristols does not include civil Britannias, the Canadair company is engaged at present in writing a specification for a military transport version of the CL-28 Britannia.

During the last year, the two-storey building housing the experimental engineering laboratory, described in our last Commonwealth Industry review, has been completed. A further $1,300,000 addition—a much larger building of more than 170,000 sq ft—is now nearing completion at Plant 1, and in it will be located the tooling department. Consisting of a main floor and a mezzanine, this building (No. 119) will house a new foundry, pattern shop, template shop and jig shop, and will provide quarters for clerical staff for production control, tool design and planning.

Under John Jay Hopkins, chairman and managing director, the executive head of Canadair is J. G. Notman, president and general manager. F. Pace, Jr., and L. B. Richardson are vice-chairmen of the board; vice-presidents in charge of manufacturing, engineering and sales are R. A. Neale, W. K. Ebel and P. H. Redpath; while J. F. Tooley is vice-president and comptroller.

CANADIAN CAR AND FOUNDRY COMPANY, LTD.

UNIQUE in the Canadian aircraft industry, if only for the sight of buses and aircraft progressing along adjacent parallel assembly-lines, CanCar's plant near Lakehead Airport, Fort William, with a sound record of aircraft production in the past, is on the threshold of big developments. Apart from current production programmes, the almost certain change in ownership bringing the company into the Hawker Siddeley Group will reinforce the Fort William facilities with strong backing on the aviation side, and should make the company's progress over the next 12 months extremely interesting.

Since last year, the company has completed its production contract for Beech T-34A Mentors for the U.S.A.F. and R.C.A.F. At the time of our visit to Fort William last month the last batch of completed aircraft was being readied for delivery to the U.S.A.F.; spares production was continuing. Among the production problems overcome in CanCar's T-34A programme were those of hot-forming bead-reinforced magnesium skins (magnesium being used for the complete tail unit, flaps and ailerons).

Also recently completed was a sub-contract order from de Havillands for wings and tail surfaces for the D.H.C.3 Otter, for which programme the original de Havilland tooling was increased and improved. A current development on the planning side is the trend towards an increased mechanization of the company's production-control systems, the aim being to reduce overheads and so reduce the price of the product—be it aircraft or coach.

CanCar's part in the Grumman CS2F-1 programme is the sub-contract production of the most complex section of the airframe—the entire wing, complete with folding mechanism. Work began in November last, and the company has now tooled up for manufacture of the centre-section and outer wings. Ailerons, searchlight installation, landing gear support, flaps, spoilers, wing-tips, undercarriage doors and centre-panel components have in turn been subcontracted by CanCar to outside firms.

A number of the Grumman-type jigs and fixtures have been combined, in line with the lower production rate (two per month) planned at Fort William, and with the consequently reduced need to sub-divide operations to any great extent. The elaborate corrugation-sandwich construction of the centre-section panels has presented a major problem in drilling and riveting, calling for extremely fine accuracy over an exceptionally large number of holes. Simplicity in design and construction is *not* a feature of the CS2F-1 centre-section, which is as a whole a most complicated assembly, again demanding precision work to very close limits. The first wing assembly should be produced in the near future.

Although the production of North American Harvards under licence was completed last year, CanCar are still producing parts for this ubiquitous trainer and sending them to many parts of the world. Last year's agreement with North American (world sales rights, excluding U.S.A., for Harvards and spares) included also the sale of a large stock of new and used spares, which are now almost completely filling one of CanCar's Lakehead hangars.

At Fort William, CanCar's top executives have proved that specialization is not essential for efficiency in production; in general, senior staff are not duplicated in separate aircraft and bus divisions. This integrated approach, with the emphasis on efficient tooling and production methods, has certainly resulted in a noteworthy record on the aircraft side to date.

The president and managing director of CanCar is Edwin J. Cosford, and L. A. Bruce is vice-president and comptroller. Divisional plant manager at Fort William is R. E. Henderson; other officials at the Fort William plant include W. Meder, general superintendent; L. B. Walker, chief engineer; and A. Norton, chief tool designer.

Mr. R. E. Henderson, divisional plant manager of CanCar at Fort William.

CANADIAN PRATT AND WHITNEY AIRCRAFT COMPANY, LTD.

CONTINUED widening in the scope of activities, and tooling-up for the production of Wright R-1820-82 Cyclones for the Grumman CS2F-1, have marked the progress of Canadian Pratt and Whitney over the last year. A reduction in the production rate of P. and W. R-1340 Wasp engines has been accompanied by a build-up of spare-parts production, so maintaining an even work-load prior to the production run of some 400 R-1820s.

At the company's two plants at Ville Jacques Cartier, outside Montreal, a total of 1,800 people are employed. The manufacturing division occupies approximately 340,000 sq ft of factory space, and over 75,000 sq ft is taken up by the overhaul and supply division. The possibilities of expanding the helicopter overhaul shop, producing helicopter components, and assembling complete machines are being studied at present.

It was with the production of Pratt and Whitney Wasp engines, installed in Harvards, Otters and S-55s (among others), that the company commenced its manufacturing activity, and peak production of these engines was reached a year ago. As mentioned, the R-1340 engine production rate has since been reduced, and now more than half the output of the manufacturing division consists of spare parts, including components for P. and W. R-985s, R-1830s and R-2000s in addition to those for R-1340s.

The significance of the Government order for Grumman CS2F-1 aircraft for the R.C.N. is reflected this year in the work of many Canadian companies. In addition to the Wright engines for this machine, certain of the Hamilton Standard propeller equipment for this aircraft is also to be manufactured by the Canadian P. and W. company. Delivery of both engines and propellers will begin this autumn and is expected to continue for several years. The Defence Department contract will certainly provide the company with an excellent opportunity to market the Wright Cyclone on a commercial basis.

While Canadian Pratt and Whitney gains much from the technical experience of the parent company at East Hartford, Connecticut, the aim over the past few years has been to develop the Canadian company as an independent unit (with the accent on flexibility of production), capable of establishing and maintaining a continuing business for both home and export markets. Although the commercial demand for new Wasp engines and parts was artificially low in the past due to the availability to operators of war-surplus stocks, much confidence is felt concerning future prospects, particularly in the transport field. The majority of parts produced at Jacques Cartier at present, incidentally, are peculiar to engines no longer on the production list of the parent company.

The original machinery and equipment installed in the manufacturing plant, which was built in 1952, was supplied under capital assistance by the Canadian Government, and a major step towards independence was recently achieved with the completion of negotiations for the purchase by the firm of this equipment. The company is itself supplying the additional machinery and equipment required for its new production programmes.

The overhaul and supply division of Canadian P. and W. continues to handle the assembly, sale, overhaul and service in Canada of all the products of Pratt and Whitney, Hamilton Standard and Sikorsky divisions of United Aircraft Corporation, other than those made by the manufacturing division; and also handles the sale, overhaul and service of Pesco accessories. A fairly constant level of sales and of employment has been maintained in Overhaul and Supply during the year. Should future requirements demand, the company is prepared to manufacture any of the United Aircraft and Pesco products which it sells and services at present.

The chairman of the board of Canadian Pratt and Whitney is James Young. Under the executive direction of Ronald T. Riley, president, the company is organized into three divisions: (1), Overhaul and Supply, headed by James Ross, who is also secretary of the company; (2) Manufacturing, divided into factory, engineering and purchasing groups under H. C. Spence, R. H. Guthrie and M. D. Beech respectively; and (3) General Administration, responsible under J. W. R. Drummond, vice-president, for sales and operations engineering and for field service; and under V. W. Tryon, treasurer, and G. G. Brooks, personnel manager, for all accounting and personnel matters.

Canadian Pratt and Whitney's manufacturing plant at Jacques Cartier, outside Montreal, where Wright R-1820 Cyclones for the CS2F-1 are to be built in quantity.

THE DE HAVILLAND AIRCRAFT OF CANADA, LTD.

ONE of the fullest and most varied production programmes in Canadian industry at present is that being followed by de Havilland Aircraft at its handsome new Downsview plant outside Toronto. As prime contractors for the Grumman CS2F-1, the company—which has never before built an aircraft of this size, nor, indeed, produced any other design under licence—is responsible for planning and co-ordinating the extensive subcontract arrangements in Canada, integrating tooling and modifications action with Grumman, building the front fuselage and preparing for the complete final assembly and installation of equipment. New contracts for 95 Otters for the U.S. Army, and 60 Chipmunks for the R.C.A.F. have formed important additions during the year to the company's production programme.

Probably the most significant stage in the company's postwar activities, excepting the design and production of the Chipmunk, was the selection in 1951 of the Beaver from many contenders as a liaison aircraft for the U.S.A.F.

Designated the L-20, it has since been in continuous production for the U.S. Air Force and Army. Over 500 L-20s have been delivered to date, and orders now on hand will keep the company busy for the next 2½ years—quite apart from orders for civil Beavers, almost 300 of which are operating at present in 36 different countries.

A second D.H.C. success with the U.S. Forces occurred this year when, following evaluation trials by Army field forces at Fort Bragg, N. Carolina, the D.H.C. 3 Otter was chosen for supply duties with the U.S. Army, to the tune of an order for 95 aircraft. The first six of these machines, designated U-1 and destined for topographical survey operations in Alaska and the Caribbean, were handed over in March; subsequent U-1s are being delivered to Transportation Corps Troop Companies for use as supply aircraft in forward areas, transporting cargo, troops, paratroops and casualties.

Among earlier customers for the Otter were the R.C.A.F., who use the type extensively for arctic search and rescue, in addition to other functions. A total of some 80 Otters have now been produced for the R.C.A.F., the Royal Norwegian Air Force, Philippine Airlines, C.P.A., and other commercial operators in Canada, Norway and Colombia. Among those on order are four for the U.S. Navy.

In 1946, it may be recalled, de Havilland Canada's design team brought out the Chipmunk primary trainer. Some 158 machines of this type were built between 1946 and 1951, when production in Canada ceased, the programme being taken over by the parent company in England. In March, 1955, following the R.C.A.F. decision to revert from the Harvard to the Chipmunk for primary training, a further order for 60 of the de Havilland machines was placed with D.H.C. From the re-started Chipmunk assembly line, the first machine was due to roll out last month.

On the Grumman CS2F-1 contract, which is for 100-plus machines, de Havilland have progressed from the early planning stage to an advanced stage of tooling, production control and subcontract co-ordination, and have commenced component production. Extremely close liaison with Grumman is being carried out, as the Canadian Navy requires complete interchangeability between de Havilland-built and Grumman-built parts.

Canadian equipment to be fitted to the CS2F-1 is at present being tested on X-500, the Grumman S2F-1 purchased from the U.S. by the R.C.N. Airframe components from the main subcontractors and engines from Canadian P. and W. should start flowing into the Downsview plant later this year, and delivery of the first completed machine should take place next spring.

On the occasion of our visit, a labour dispute was threatening to retard planned schedules; at the time of going to press, there had been no production at Downsview for over a month (including two-week annual holiday period).

A considerable expansion of the company's guided-weapon department has taken place over the past year, and there has been extensive liaison with the D.H. Propeller Company at Hatfield, both in connection with the training of personnel and with the exchange of technical data on the components being designed by D.H. Canada.

In the government-owned, de Havilland-operated engine division factory covering 90,000 sq ft on the north side of the airport, R.C.A.F. Orendas and Goblins are presently being overhauled at the respective rates of 10-12 and 2-4 per month. A contract for the overhaul of some 300 J47s has recently been completed there. In addition, overhaul work on the Gipsy Queens and Majors of Doves, Herons and Chipmunks is continuing. A new stores and static test rig building, of 60,000 sq ft, has come into use during the year.

With the increase in activity due to the CS2F-1 and Chipmunk programmes the number of people employed at D.H. Canada has increased by some 600 over the past twelve months, and now totals just over 3,000. With Sir Geoffrey de Havilland as president, the executive head at Downsview is P. C. Garratt, vice-president and managing director. Other Canadian directors are C. H. Dickins (sales), G. J. Mickleborough (secretary-treasurer), W. D. Hunter (engineering), R. Bannock (military sales), F. A. Stanley (comptroller) and W. W. Parry, Q.C.

The Canadian Industry . . .

Symbolic of future production at Downsview: Grumman S2F-1 Sentinel of the R.C.N. over the D.H.C. plant.

At Fort Erie, home of Fleet and Doman-Fleet: H. L. Eberts (president), D. Bryon (pilot), W. Weymouth and the LZ-5.

THE FAIREY AVIATION COMPANY OF CANADA, LTD.

TWO new plant facilities, full production of Fairey power controls, and an extension of overhaul and repair work to two new types of aircraft have signified the development of the Canadian Fairey company over the past 12 months.

The major physical expansion has been the opening in March of the company's new base on the west coast of Canada, at Patricia Bay Airport, Sidney, B.C. Although only a relatively small unit—the main hangar covers some 50,000 sq ft—modern machinery and equipment is being installed, and there is room (and a firm expectation) for future enlargement. The staff of 50 are at present working on the overhaul and repair of Avengers for certain R.C.N. units on the west coast.

At the company's main base at Eastern Passage, Nova Scotia, one of the major conversion contracts has involved the re-equipping and modernizing of Grumman TBM Avengers for the Canadian Navy—whose Air Arm headquarters are at H.M.C.S. *Shearwater*, just a three-minute drive from the Fairey plant. The company is particularly proud of this accomplishment in fitting Avengers with highly refined anti-submarine equipment—including M.A.D. booms—which has enhanced and extended the useful life of this machine. Other conversion work has been performed on Lancasters for the R.C.A.F., and on Sea Furies for the R.C.N.

Although overhaul, conversion and repair are the Fairey company's main functions, the manufacture of Fairey Hydro-booster units, which are fitted to the flying controls of the CF-100, has built up into a sizeable business and is now continuing at a high rate. Spare parts, for installation and for Service stores, are also being produced, and an order is in hand for certain hydraulic equipment for the Canadair CL-28. A 7,000 sq ft extension to the main factory has recently been occupied: this is devoted to work on electrical instruments and equipment. A further expansion of activity in the electronics field is forecast, and provision has been made for a second storey to be added to the new electrical block.

In service with the R.C.N., the McDonnell Banshee has replaced the Sea Fury, and the Fairey company is now starting a repair and overhaul programme on this newer type. Another new type, soon to be handled at Eastern Passage, is the Lockheed P2V-7 Neptune, which is to replace the Lancaster for R.C.A.F. maritime reconnaissance duties.

Looking further ahead to the replacement of the veteran Avengers by CS2F-1s, the probability is that this machine, too, will be overhauled as necessary by Fairey for the Canadian Navy.

Managing director of the Fairey Aviation Company of Canada is C. E. Hibbert. At Eastern Passage, A. C. Earle is plant manager; E. C. Garrard, chief designer; W. J. May, chief inspector; and A. M. Cameron, secretary-treasurer. Plant manager at Patricia Bay is D. W. Howell. The number of people employed by the company has remained fairly constant over the last year at about 850.

FLEET MANUFACTURING, LTD.

IN spite of a reduction in personnel caused by a withdrawal of Sabre sub-contract work, Fleet Manufacturing at Fort Erie have managed to retain a healthy position this year, with commendable production records in the fields of aviation and ground radar equipment. The company is engaged on novel processes in connection with the CS2F-1 programme, and has progress to report on two promising new developments.

Following the termination of the 1953 management agreement with Canadair, which had brought to Fleet H. L. Eberts and B. Daniels, the Fort Erie company returned to independent status, Mr. Eberts and Mr. Daniels electing to remain as president and general manager, and manufacturing manager, respectively. Fleet's activities since then have been mainly centred around sub-contracts with three major aircraft firms—Canadair, Avro Canada, and Republic Aviation—and two major electronics companies—Canadian G.E.C. and Northern Electric. More recently, work for de Havilland Canada has been undertaken.

For Canadair, until the withdrawal of work to that company's plant following the stretch-out in Sabre production last December, Fleet had made a large number of wing and fuselage assemblies and components for the Sabre. The cessation of this work naturally came as a serious blow to Fleet's activities, and caused a reduction in staff of over 200. For the Avro CF-100, the company continues to make flaps, ailerons and a number of classified components.

Other work which has continued during the last 12 months includes the manufacture of nose-wheel components for the Republic F-84; and massive radar antennae and towers, and microwave units, for the electronics firms mentioned above. New contracts on the aircraft side include honeycomb sandwich sections (bomb-bay doors, nose-wheel doors, escape hatches and access covers) for the CS2F-1 for de Havilland—using techniques

Fairey's new base at Patricia Bay on Canada's west coast, where overhaul and repair of R.C.N. Avengers is carried out.

Home of Rolls-Royce Canada, on Cote de Liesse Road, Montreal.

The Canadian Industry . . .

fairly new to Canadian industry—and floors for the Otter and Beaver. Other CS2F-1 work being performed at Fleet includes the production of plastic wingtips under sub-contract to MacDonald, and the tooling and manufacture of flaps and spoilers for CanCar.

In addition to its subcontract work for other companies, Fleet has an active interest at present in the complete manufacture of two types of aircraft, the Helio Courier and the Doman LZ-5 helicopter. Component parts of six Courier airframes have been built at Fort Erie, and continued future production there is planned, dependent on the results of a market evaluation being carried out at present. Fleet possess manufacturing and sales rights for this machine for Canada and the Commonwealth.

By agreement between Herman Eberts of Fleet and Glidden Doman of Doman Helicopters, Danbury, U.S.A., a jointly owned Canadian subsidiary known as Doman-Fleet Helicopters, Ltd., was recently formed to market the LZ-5 six-seat helicopter in Canada and the Commonwealth. Of the three machines of this type built to date, two were constructed at Danbury and one has been built at Fort Erie. The result of C.A.A. certification trials of the LZ-5 is now awaited, and a production batch is to be built by Fleet.

Just under 600 people are now employed at the Fort Erie plant. As mentioned, H. L. Eberts is president and general manager of Fleet Manufacturing, and R. B. Daniels is manufacturing manager. Chief engineer is H. Louis, and N. E. Butler is secretary-treasurer.

Doman-Fleet Helicopters, Ltd., is headed by G. S. Doman (chairman) and H. L. Eberts (president); N. E. Butler is secretary-treasurer and D. Hanchet is contracts and service manager.

ROLLS-ROYCE OF CANADA, LTD.

WITH the introduction of the Vickers Viscount to the North American continent, Rolls-Royce activities in Canada have been "beamed" increasingly towards the Dart turboprop during the past year. Forthcoming completion of the Canadian-built Nene 10 programme, and an overhaul interest in the Westinghouse J.34 are other notable facts concerning Rolls-Royce of Canada at the present time.

At the smart Rolls-Royce plant on Cote de Liesse Road, Montreal, a six-month supply of spares for each component of the Dart is maintained for the Viscount's North American operators (T.C.A., Capital, Canadian Dept. of Transport and British West Indian Airways), who are guaranteed a 30-day delivery of any part, and also receive technical assistance. As the number of Viscounts in operation increases, more spares will be held and an over-the-counter service in engines and parts will be provided. During recent months, a team of ten specialists has been working with Capital Airlines at Washington, as part of the company's technical service.

Over forty of the planned 50 Nene 10s to be built in Montreal have now been completed, with the assistance of a large number of subcontracting companies. These 50 Canadian-built Nenes formed part of the 1951 order for 900 (for Canadair-built T.33s) which made up the company's initial project. Production at Montreal began in 1953. At the time of our visit last month, more than 850 Nenes had been delivered—all ahead of schedule—and completion of the order is expected this month. Completion of deliveries will be followed by the manufacture of spare parts, and by continued overhaul. At about this time last year, the first Canadian-built Nene successfully passed its R.C.A.F. 150-hr type test and other T.33 Nenes were just beginning to reach 500 hr, their overhaul life; during the past 12 months, twelve have been examined after 500 hr and the life has been raised to 750 hr. An early further increase to 1,000 hr is anticipated.

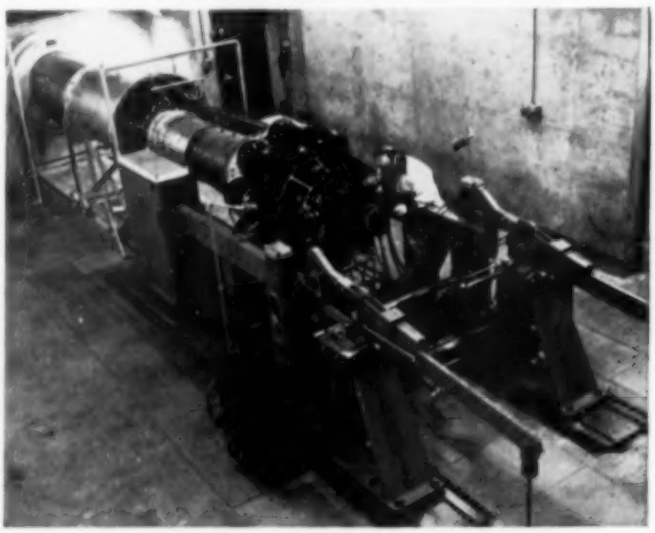
The Westinghouse J.34 turbojets in service with the Canadian Navy's Banshees are to be overhauled by Rolls-Royce of Canada—a logical step in view of the existing Rolls-Royce/Westinghouse technical liaison agreement. Spares will come, via the R.C.N., from the U.S.N., as the Banshee programme is a Navy-to-Navy arrangement: the Rolls-Royce function will be mainly overhauls, plus technical representation in the field.

The Rolls-Royce Merlins in T.C.A.'s North Stars are now running at an overhaul life of 1250 hours, and the Canadian Department of Transport have agreed in principle to an extension to 1500 hr.

Expansion of the Rolls-Royce plant during the last 12 months has included the construction of a two-storey section which houses the millwright section of the aero-engine division and additional design and engineering offices, in addition to a maintenance section for the car division and an overhaul section for the industrial engine division. Provision has been made for future expansion, both in this new addition and on the 102-acre site as a whole. And further expansion seems highly probable, for the Rolls-Royce team on Cote de Liesse Road have built up a well-deserved reputation for thorough, punctual and efficient service during the 2½ years the plant has been in operation.

Lord Hives is president of the Board of Directors of Rolls-Royce of Canada. At the Montreal plant, the general manager is R. M. Kendall; David Boyd. O.B.E., is works manager; and Ian Turner is financial and commercial manager and secretary. James Hall, K. J. Grundy and A. M. Scott are managers in the aero-engine division responsible for engineering services, production, and sales respectively.

Nene 10 in test-bed at the Rolls-Royce plant: 50 of these engines are being built at Montreal.



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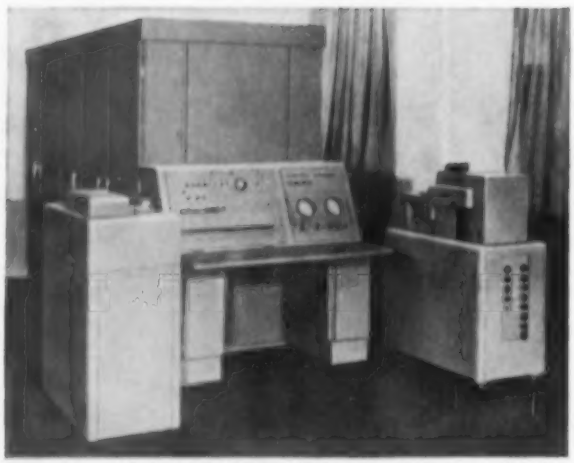

General view of DEUCE showing the input and output card units and control desk.

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Seen in Canadair's flight-test hangar, these glossy Sabre 6s and T-33s incorporate the work and products of many ancillary Canadian companies, whose activities are described in the following pages.

THE CANADIAN INDUSTRY . . . Ancillary Companies

Aluminium Company of Canada, Ltd.

CANADA, pre-eminent as an aluminium-producing nation, owes much to her great hydro-electric developments. Last year's production by the Aluminium Company of Canada (Alcan) amounted to 561,000 tons. Although consumption in Canada has been increasing steadily since 1945, Alcan still exports over 80 per cent of her primary metal; in 1954, for example, the U.K. imported 216,000 tons of aluminium from Canada.

In addition to smelters at Arvida, Isle Maligne, Shawinigan Falls and Beauharnois, all in Quebec Province, and now Kitimat, the company has fabricating plants at Kingston and Etobicoke in Ontario, Arvida and Shawinigan Falls in Quebec. The Kingston plant has been producing high-strength aluminium aircraft alloy sheet, extrusions and forgings in increased quantities. Etobicoke is supplying mould, die and sand castings.

Alcan's importance as a large-scale supplier of aluminium alloy ingot and fabricated components to the world's aviation industries is enhanced by its having available the research facilities of Aluminium Laboratories, Ltd., its sister company in the Aluminium, Ltd., group. Aluminium Laboratories, with a staff of over 400 working in modern research laboratories at Kingston and Arvida in Canada, and Banbury in England, carries on extensive research in production alloying and fabrication techniques.

Alcan's position is now strengthened by the new production facilities at Kitimat, British Columbia. Production commenced here last August at the rate of 91,500 tons per annum, and an expansion project, now under way, will effect an additional capacity of 240,000 tons annually. Ultimately an annual capacity of 550,000 tons is planned, which will duplicate present production capacity in eastern Canada. Power for Kitimat comes from an underground power-house located at Kemano, fifty miles distant. Water from a series of high-level lakes feeds the turbines at Kemano through a ten-mile long, 25ft diameter tunnel which has a drop sixteen times that of Niagara Falls. When the project has been developed to its fullest extent Kemano will have an installed generating capacity of 2,200,000 h.p.

Aviation Electric, Ltd.

AVIATION ELECTRIC was founded in 1931 as the Canadian office for Scintilla, with only three men; Alfred Bandi, the present president; Hermann Wyler, now vice-president, and one additional shop employee. Following a steady growth, and the recent move to a new modern plant of 96,000 sq ft on Laurentian Boulevard, Montreal, approximately 610 people are now employed at this main plant, together with a small west-coast unit at Vancouver.

From the beginning A.E.L. has specialized in sales and overhaul of aircraft instruments and accessories of all types. The company is fully equipped with modern facilities to undertake the manufacture, overhaul and, when required, the design and development of aircraft and industrial instruments, accessories, dies, jigs and fixtures. For over 15 years the firm has continued to be a large producer of all types of precision moulding dies for the plastics industry as well as for the die-casting industry.

Some 80 per cent of the total plant space is allocated to overhaul and manufacturing. The facilities include instrument and accessory overhaul shops and, for the manufacturing division, component fabrication shop, tool room, assembly shop, inspection and environmental testing, together with standards room, control laboratory, and plating and heat-treating room. A second-storey extension, to house office, engineering and development personnel, and covering some 20,000 sq ft, was under construction at the time of our visit.

In volume, approximately half the company's business is concerned with straightforward sales and service of the products

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listed below. Twenty-five per cent relates to overhaul contracts for R.C.A.F. and R.C.N. instruments and accessories, while the remaining quarter consists of the manufacture under licence of selected products of firms represented when, for instance, the Department of Defence Production decides those products should or could be made in Canada.

The Bendix Aviation Corporation is the major organization whose products are distributed by A.E.L. The relevant divisions of this Corporation, and respective products, are: Bendix Radio (aviation and mobile radio equipment), Eclipse-Pioneer (flight, engine and navigational instruments and aircraft electrical and mechanical accessories), Pacific (aircraft hydraulics, guided-missile telemetering), Red Bank (generators, alternators, other rotary electrical equipment), South Bend (fuel metering and landing-gear equipment), Utica (aircraft starters), Scintilla (aircraft magnetos and A.N. connectors).

Other agencies possessed are those of Hymatic (aircraft pneumatic systems and components), Lodge Plugs (spark plugs and ceramics), Teddington Controls (engine and cabin pressurization controls, valves and accessories), Kenyon Instrument Co. (aircraft photographic, mechanical and hydraulic equipment), Robinson Aviation (shock mounts and vibration isolators), Newton Darby (voltage regulators) and Ideal Arosmith (test equipment). In addition, the company manufacture the Kelvin and Hughes turn-and-slip indicator Mk 2, Type 14, for the R.C.A.F.

Future plans include a concentrated effort towards an expansion of the engineering department. President of Aviation Electric is Alfred Bandi.

Canadian Aviation Electronics, Ltd.

ON June 16th, 1955, Canadian Aviation Electronics celebrated the first anniversary of the opening of its modern plant on Cote de Liesse Road, Montreal. Among the company's accomplishments during the first year of operations in its new plant are the design, development and manufacture of many electronic and communication products, and of nucleonic devices; pioneering work in aviation electronics; and maintenance and installation work in Canada, Europe, Asia and South America.

One of the most intricate electronic devices yet produced by a Canadian company, the Curtiss-Wright Dehmel Flight Simulator for the CF-100, is being manufactured under licence from the Curtiss-Wright Corporation. This contract, from the Department of Defence Production on behalf of the R.C.A.F., has involved design and development work on the prototype, as well as the manufacture of production units.

An interesting and ambitious project being carried out by the company at present is the design of a prototype drogue target aircraft. The complete design, including aerodynamic and structural analyses in addition to electronics, is being performed by a special project group at C.A.E.

Another major project undertaken by C.A.E. comes under the heading of radar fire control, in which field the company possesses equipment which is unique in Canada. Amongst the large range of telecommunication and radio navigation equipment produced by C.A.E. is a V.O.R. unit, as installed by the Department of Transport, Ottawa. The company also produces a number of

Mr. K. R. Patrick, O.B.E., president of Canadian Aviation Electronics.

V.H.F. omni-range systems and has been prominent in the installation of radar chains across Canada.

Among other products which have been developed, the nucleonic instruments designed and manufactured in the Winnipeg Plant deserve special mention. Winnipeg-developed scintillometers have already proven themselves in many countries, and the company has now developed an airborne scintillometer for aerial survey of radio-active ore.

The manufacture under licence of Lear autopilots is carried out by C.A.E., which is also the exclusive distributor in Canada for Ultra Electric's SARAH. With 1,400 people employed across Canada, C.A.E. forms the largest Canadian-owned electronics company. A programme of plant extension in various locations across Canada is at present contemplated.

Present plant areas are: Montreal, 136,000 sq ft (plus 28,000 sq ft; Consumer Products Division); Toronto, 12,000 sq ft; Winnipeg, 55,000 sq ft; and Vancouver, 12,000 sq ft. President and managing director of Canadian Aviation Electronics is K. R. Patrick, O.B.E.

Canadian Marconi Co.

SINCE its establishment in 1902—a year after Marconi received, in Newfoundland, the first transatlantic wireless message—the company has been the exclusive agent in Canada of the English Marconi Co., and has been entitled to the same rights in Canada as have Amalgamated Wireless in Australasia. In 1953 the links were further strengthened when the English Electric Co. (of which Marconi's Wireless Telegraph Co., Ltd., is a subsidiary) purchased from Cable and Wireless, Ltd., the latter's majority shareholding in the Canadian Marconi Co. Thus, the resources in research, development and production both of Marconi's Wireless Telegraph Co., and of English Electric are fully available to the Canadian company, and *vice-versa*.

The aviation side of the Canadian organization is comparatively young, yet at the present time is in a position to offer a complete range of equipment and full repair and maintenance service. It is responsible for the maintenance of the Marconi radio-compasses in T.C.A.'s Viscounts, now well-established on Canadian routes. The president of the company is S. M. Finlayson.

Instrument overhaul shop at Aviation Electric, Montreal.

Dowty's modernized South Plant at Ajax. New undercarriage drop-test rig is housed at far end.

Computing Devices of Canada, Ltd.

COMPUTING DEVICES OF CANADA, LTD., Canadian owned and operated, was founded in 1948. This Ottawa company specializes in the field of instrumentation and electronic computation, and has a staff of over 300 of whom 75 are graduate engineers—an unusually high proportion. From this team has been conceived a succession of new developments in aircraft instrumentation and electronic data processing.

Of major importance is the company's achievement in producing the first "push-button aircraft navigator," or Position and Homing Indicator which, free from radio aids, computes dead-reckoning for the pilot and provides a continuous presentation of the aircraft's position with reference to any given location in a 600-mile radius. Although specifically designed for military purposes, the principles can now be applied to commercial use.

The company has an engineering group specializing in aircraft instrumentation research, development and manufacture, and is currently engaged in work connected with Canada's military requirements. The original function of the company (the construction of special-purpose computers) having been established in 1948, the pattern of progress led also into the field of scientific and commercial computers. Computing Devices of Canada represents, on an exclusive basis, some of the foremost manufacturers and has supplied a large percentage of the existing computers in Canada, mainly in the aircraft and engineering data processing spheres. The company now represents Boeing Aircraft, Elliott Brothers Ltd., the Electronics Division of National Cash Register Company (formerly Computer Research Corporation), and associated equipment manufacturers, Benson-Lehner Corporation and Commercial Controls Corporation.

Owning and operating analogue computer equipment, and shortly adding a high-accuracy digital facility, Computing Devices maintains a staff of a Head (data processing) and seven mathematicians, at various locations, the main computing centre being in Ottawa. Services are performed for government applications, and programming of problems is performed for industry prior to the purchase of computer systems.

Of necessity, a large engineering and field maintenance force is maintained. C.D.C. also strengthened its growth in 1953 by supplementing its technical services with the sale of allied instruments and components to the aircraft and electronics industries. Today the company is the Canadian sales representative for Texas Instruments Inc. (transistors and apparatus), Laboratory for Electronics Inc., Commercial Controls Corporation, Teletronics Inc., Goodmans Industries Ltd., Northeastern Engineering, Solartron Electronics Group, Convair (Charactron), and Radiation Counter Laboratories.

The 40,000 sq ft of plant and office area is very shortly to be expanded by the completion and occupation of a new plant at Ottawa. At the existing premises there are excellent research and development laboratories, model shops and production shops; and a special assembly area for precision instruments is dust-proof and temperature and humidity-controlled.

Computing Devices of Canada, Ltd., has as its president and general manager C. F. Hembery.

Decca Companies in Canada

THE formation of **Decca Navigator (Canada), Ltd.,** last December was the major development in Decca activities in the Dominion over the past year. Apart from its function as a general short-range navigational aid, the Decca Navigator system is felt to have a special value for Canada in connection with hydrographic and topographical survey, oil exploration, etc., using light-weight transportable ground station equipment.

Decca Radar (Canada), Ltd., has now been in operation for over a year and possesses, in addition to the Toronto headquarters, branch offices in Montreal and Halifax. It is concerned with the sale, installation and servicing of Decca radar equipment, and until the formation of the Canadian Navigator company acted, in addition, as representative for the U.K. Navigator company. Products handled include airfield control radar (Type 424), storm-warning radar, millimetric radar for airport ground-movement control, and microwave test-gear, in addition to marine radar equipment. General manager of both companies is L. J. Dennet.

Dowty Equipment of Canada, Ltd.

THE modernization and extension of the company's South Plant at Ajax, Ontario, a considerable expansion of test and development activities, and an increase of personnel of some 25 per cent, are among the main features of the activities of Dowty of Canada over the past 12 months. Due largely to continued participation in the Avro CF-100 programme (undercarriage units, flap and dive-brake jacks, and other components) the company has handled the largest volume of business since its establishment at Ajax.

The repair and overhaul activity—serving some 15 separate types of aircraft fitted with Dowty equipment— has also made a significant contribution to the company's volume of work. Manufacture and overhaul of wheels, brakes and control equipment designed by the Aviation Division of the Dunlop Rubber Company have also continued, under licence agreement.

It was decided in 1953 that the Canadian company would do an increasing amount of design and development work, and this decision has been implemented by an expansion of the engineering department to a total of some 50 experienced engineers and technicians. It was apparent on our visit that the firm now feels an extremely strong and capable design team has been gathered together, which can count on the additional backing of the parent organization in basic design and research. It is significant that all of the relevant engineering proposals called for in the procurement phase of the Avro CF-105, Canadair CL-28, and D.H.C. CS2F-1 programmes during the past year have been prepared by the Ajax staff.

On the CS2F-1, Dowty's participation involves the manufacture of the Bendix-designed nose undercarriage, plus other hydraulic units. The company's design contract for the CF-105 is for the main undercarriage. These projects form the major new work begun during the last 12 months.

Compared with its original appearance, Dowty's South Plant at Ajax is now barely recognizable. Onto the basic skeleton framework of the buildings has been grafted an attractive, well-designed contemporary exterior. In this unit are housed the development engineering section (including test facilities), industrial section, service department, and repair and overhaul section, while design and manufacture are concentrated in the larger North Plant. Among the test equipment installed in the development section is the new undercarriage drop-test rig, the only one of its type and size in Canada, which is capable of testing landing gear for aircraft of 30,000-175,000 lb all-up weight. Provision has been made for simulating wing lift and climatic variations, and complete electronic instrumentation is available. A similar smaller rig is being installed for testing lighter types of equipment.

The extension of test facilities includes also static, structural, and hydraulic performance testing equipment, in line with the practice of intensive development and qualification testing common to the equipment market in North America. Process development work is also being undertaken on the use of ultra-high-strength steels and butt welding applied to the firm's products.

The industrial division has experienced a steady increase in activity over the past 16 months, new applications of hydraulics to agricultural and other commercial fields having been introduced.

The total floor area devoted to aircraft work at Dowty's two Ajax plants is approximately 50,000 sq ft, and 425 people are employed. The president and general manager is R. F. Hunt.

Godfrey Engineering Co., Ltd.

A RECENT expansion has taken place at the Montreal plant of Godfrey Engineering, Canadian affiliate of Sir George Godfrey and Partners of Hanworth, Middlesex, designers and manufacturers of cabin pressurization and air-conditioning equipment. Manufacture, sales and service are performed by the Canadian company, which was founded in 1947, the main products being cabin superchargers, cold-air units, ground servicing equipment, pressure-cabin testing trolleys, oxygen servicing trailers, hydraulic filling and bleed units, hydraulic hose testers and ground air-conditioning units.

Canadian and American aircraft utilizing Godfrey equipment include the Avro Aircraft CF-100 (cabin superchargers and refrigeration units), T.C.A.'s North Stars (cabin superchargers), and the Viscounts of both T.C.A. and Capital (cabin superchargers and refrigeration units).

Research and development on new items of both airborne and ground air-conditioning equipment is continuing. The company acts as Canadian representative for the Pacific Airmotive Corporation of Burbank, California, manufacturers of cabin pressure-control equipment and valves. The president and general manager of Godfrey Engineering is W. F. S. Carter.

One of the Aeromagnetic Surveys, Ltd., "Flying Geophysics Laboratory" Cansos. Electromagnetometer and tail magnetometer are visible.

The Canadian Industry . . .

Hunting Associates, Ltd.

AN increase in activity in the field of airborne geophysics, the entry of the Hunting group into the electronics field, and the construction of a large new environmental-test laboratory at Toronto have formed the main developments in the operations of the Hunting member-companies during the past year. Hunting Associates, Ltd., was formed last year, with D. N. Kendall as executive vice-president, as a holding company to direct and integrate the activities of the Photographic Survey Corporation, Ltd., and its associates and subsidiaries; brief progress reports on individual companies follow.

Photographic Survey Corporation, Ltd.—Since the aerial mapping of 127,000 sq miles of Ontario's forest resources, the company's first major project, completed in 1951, P.S.C. has built up an impressive record of airborne natural-resources surveys of many types. One of the most comprehensive has been the 300,000-sq-mile survey of West Pakistan, sponsored by the Canadian Government under the Colombo Plan. The air-survey side of this operation has now been completed; controlled mosaics for land-reclamation and irrigation schemes are now being prepared by P.S.C. specialists at the Toronto headquarters; and reports of geologists and soils experts are being integrated with the air survey devoted to "soils and land use." Large-scale maps of Hyderabad and Karachi, also, are being prepared for community planning. Geological exploration by helicopter has been performed in Northern Canada; the Northwest Atlantic harp seal population has been determined by air photographs for the Canadian Fisheries Research Board; and two P.S.C./Kenting Cansos are to be used in the forthcoming Antarctic aerial survey covering some 50,000 miles of the Graham Land Peninsula. Vice-president and general manager of P.S.C. is W. H. Godfrey.

Component parts of the R-Theta computor, development of which marked the recent entry of Hunting companies into electronics.

P.S.C. Applied Research, Ltd.—Formed in 1951, the company is engaged in the development and manufacture of mechanical and electronic instruments and other precision equipment. For the CF-100, A.R.L.'s control intervalometer is used to govern the rocket-firing pattern, and the company's automatic ice-detection and shedding control system is fitted, in addition to a high-speed Air Position Indicator. Towards the end of 1954 the R-Theta Computor, invented by W/C. J. G. Wright and developed by A.R.L., was announced—marking the entry of the Hunting group into electronics—and this device may also be fitted to CF-100s. In the company's recently completed environmental-test laboratory, vibration equipment, altitude chambers, humidity chambers, shock-testing equipment, a 200 mph wind-tunnel, and other physical testing equipment are being installed. The company's scope has recently been further widened to include precision optical instruments, though an association with Physical Measurements Co., Ltd., of Winnipeg. Managing director of P.S.C. Applied Research, Ltd., is J. M. Bridgman.

Aeromagnetic Surveys, Ltd.—Aeromagnetic Surveys, or A.S.L., was established in 1950 to take over P.S.C.'s expanding aeromagnetic operations. Three types of airborne geophysical survey are now being carried out, using (a) magnetometers for magnetic types of ore deposits, (b) scintillation counters for radioactive minerals, and (c)—an important recent development which has increased the company's business considerably—electromagnetometers for sulphide ores containing lead, zinc, copper or nickel. For use over mountainous country, a special electromagnetometer has been developed for helicopter use and is at present being tested by an enthusiastic small A.S.L. unit at Oshawa. Main headquarters remain at Toronto, divided into two sections known as Plant 1 (administration and engineering) and Plant 2 (production) and employing some 250 people. D. G. MacKay is general manager.

Kenting Aviation, Ltd.—Based at Oshawa Airport, Ontario, Kenting is the operating company for the aircraft used by P.S.C. and A.S.L., which vary in size from a Cessna 180 to Boeing B-17Gs. The fleet includes three Cansos, two of which are fitted with each of the three main installations mentioned above, well meriting the name "Flying geophysical laboratories". One Canso was being prepared for the Antarctic photographic survey when we visited Oshawa; it will be used on geophysical work in the interim. A. F. Soutar is manager of Kenting Aviation.

Field Aviation Co., Ltd.—Primarily concerned with the maintenance, overhaul and special-purpose modification of Kenting's aircraft fleet, Field also performs maintenance work for the R.C.A.F. both at Oshawa and at Service stations.

The company is the exclusive Canadian sales and service agent for the aircraft of Blackburn, Hunting Percival and Beech (a Blackburn/Field tanker-version of the Beverley was recently

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Nimonic 100 marks yet a further stage in the development of alloys for use at extreme temperatures. Like other alloys in the series it has a very high resistance to creep. It may be used at temperatures some 30°C. higher than those permissible for previous alloys in the Nimonic series. Supplies for experimental engine testing are now being delivered to engine builders. The reliability of the Nimonic Alloys has been proved repeatedly both in endurance tests and in service. That is why one or another of these high-temperature alloys is used for the moving blades of every British aircraft gas turbine in service.

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ON THE VISCOUNT ... AN EMBLEM OF LEADERSHIP

First on the North American continent to appraise the basic importance of the Rolls-Royce propeller turbine engine, TCA this year has introduced Canada and the United States to the hushed, restful flight of the Vickers Viscount. Another distinction for the Maple Leaf fleet, also operating Super Constellations on the trans-Atlantic air route, and flying 1,500,000 passengers a year.

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The Canadian Industry . . .

devised, and the Morane-Saulnier MS.760, *via* Beech, is being brought on a demonstration tour of Canada this year), and are distributors of Blackburn-Turboméca gas turbines. Other agency lines recently taken over from MacDonald Bros. (paints, dopes, airscrews, instruments, accessories, metal and plastic components) have enlarged the company's scope further; for some time they have handled the products of firms including Smith's Aircraft Instruments, G.Q. Parachute Co., Bryans Aeroquipment, P. Frankenstein, Skyhi, Murex, and Fireproof Tanks. Aircraft servicing shops are maintained at Calgary Airport, in addition to the main base at Oshawa. George Suarez is general manager of Field Aviation.

Another regional associate company in the Hunting group is **Photographic Surveys (Quebec), Ltd.,** at Montreal, whose president is P. F. Osler.

The International Nickel Co. of Canada, Ltd.

THIS company is a major producer of nickel, as widely used in the aircraft industry and, in particular, for gas-turbine alloys (e.g. Nimonic and Inconel). The company operates mines in the Sudbury, Ontario, area; a smelter and copper refinery at Copper Cliff, Ontario; a nickel refinery at Port Colborne and laboratories at Copper Cliff.

Through its subsidiary, International Nickel, Inc., of U.S.A. it also operates rolling mills at Huntington, W. Virginia, and has laboratories at Bayonne, New Jersey. In addition, another subsidiary, the Mond Nickel Co., with its controlled company, Henry Wiggin and Co., Ltd., conducts reduction and fabrication operations in the U.K.

International Nickel and its subsidiaries employ 25,500 men, and last year operated at a nickel production rate in excess of 282 million pounds. The company also produces substantial amounts of copper and is an important producer of the platinum groups of metals.

The company's current aircraft products include alloys for high temperature service blading of British gas turbines; all Nimonic blading of Canadian-built turbojets; Inconel and its modifications; Nimonic and Inconel flame-tubes; Inconel for insulating blanks, and Monel tie wire.

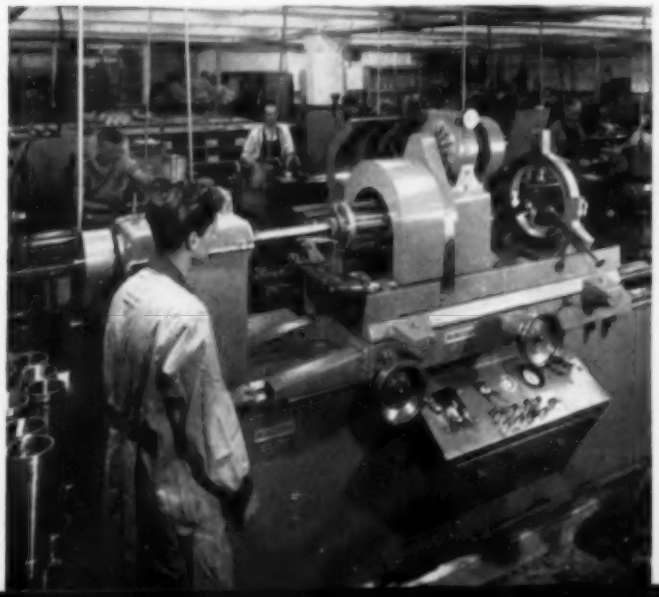
President of The International Nickel Co. of Canada, Ltd., is Henry S. Wingate.

Jarry Hydraulics

THE Jarry Company at Montreal continues with the manufacture of hydraulic components for the Canadair-built F.86 Sabres, and full production of landing gear and other hydraulic units is under way for T.33 spares. In addition to various assemblies being made for the D.H.C. Beaver and Otter, contracts have been received from de Havilland for the manufacture of the main landing gear and other hydraulic equipment for the Grumman CS2F-1.

"Americanization" for Canadair of the British Messier landing gear for the CL-28 version of the Britannia has been completed and the company is now proceeding with tooling for the production of this undercarriage, which is the largest ever produced in Canada. This is the only sub-contract work being placed by Canadair for this aircraft. Under a licence arranged with the H. M. Hobson Company of Wolverhampton, Jarry Hydraulics will also make the Hobson feel-simulator for the CL-28.

An internal grinder, Jarry-designed and made, in use at Jarry's Montreal plant.



The manufacture of control actuators designed by Jarry for the Avro Aircraft CF-105 has commenced, and the company is now adding facilities for full qualification and environmental testing of these and other units being designed. Avro have also entrusted Jarry with the complete design and production of the nose landing gear for their CF-105. This design, which is almost completed, embodies a novel steering mechanism.

The Jarry company, which was the first in North America to enter the field of high-pressure (4,000 p.s.i.), high temperature (275 deg F) hydraulics for aircraft, is the North American licensee for the Pulsometer Engineering Company, of Reading, England. Fernand Jarry is the president of the company, which employs some 200 men. Approximately 50,000 sq ft is devoted to aircraft work at the Jarry plant in Montreal.

Lucas-Rotax, Ltd.

MAIN development at the Lucas-Rotax plant at Scarborough, Ontario, during the past year has been the introduction of an engineering design section capable of carrying out the design and development, as well as manufacture, of new fuel-systems and electrical equipment. The purchase by the company of the 120,000 sq ft plant and site from the Canadian Government last autumn was another significant event.

While an expansion of the Scarborough plant is planned for the future, the trend over the past year has been to pack more into the existing space. The combustion laboratory has been enlarged, an auxiliary-drive turbine test rig has come into use, and the development section's hydraulic test equipment has been increased. Projects include the development of an air-turbine-driven fuel pump, a complete fuel-system design for the Orenda PS-13, a complete proposed electrical generating system for the CF-105, a navigation-light flasher unit, high-ignition coils, pneumatic starters and new ground equipment for testing aircraft electrical systems.

Since last year, the new proportional flow control and emergency flow control for the Orenda 14s fitted to Canadair's Sabre 6s have been put into production. In addition to the well-planned and well-kept plant at Scarborough (winner of this year's *Good Housekeeping* Award, a notice in the shops proclaims), the company has a Montreal unit near Dorval Airport which handles the overhaul and repair of Lucas-Rotax products.

The company's general manager is now R. C. Padget, and C. Bottoms is chief engineer. J. Hulbert continues as commercial manager.

Noorduyn Norseman Aircraft, Ltd.

THIS company, originally incorporated under the name of Noorduyn Aircraft Repairs, Ltd., as a subsidiary of Noorduyn Aviation, Ltd., in 1942, was reactivated in 1953. It owns the manufacturing rights, engineering drawings and tools, etc., of the well-known Noorduyn Norseman 8/10-seater transport aircraft. Produced in large numbers for the R.C.A.F., U.S.A.F. and civilian operators before, during and after the war, these machines are still widely used in Canada and abroad.

The main object of the revived operation of Noorduyn Norseman Aircraft is to provide spare parts and engineering service for these aircraft. A large stock is carried, and the manufacture of parts and special handling equipment is carried on as market conditions require. The president of the company is R. B. C. Noorduyn.

Normalair (Canada), Ltd.

NORMALAIR (CANADA), LTD., established in 1952, have recently moved into new and completely re-equipped factory premises at Etobicoke, Toronto, adjacent to A. C. Wickman, Ltd., with whom they are now associated.

The Wickman Company is well known in Canada as manufacturers of tungsten carbide cutting tools and gauges, and as machine-tool distributors, and the company's extensive machine shops are now fully available to Normalair (Canada). Normalair's activities continue to be concerned with the manufacture, repair and overhaul of cabin pressurizing and air-conditioning equipment, and the representation in general of the English Normalair company of Yeovil.

The manager of Normalair (Canada), Ltd., is P. G. Browne.

Northwest Industries, Ltd.

ONE of Canada's leading aircraft repair and overhaul companies, Northwest Industries is largely engaged in work on airframes, accessories, instruments and electronic equipment for the R.C.A.F. at the present time. The company also numbers amongst its customers some of the principal civil operators in Canada.

The company is authorized by the Douglas Aircraft Company,

of Santa Monica, as a service centre for DC-3s and C-47s, and is tooled and equipped to handle all modern types of aircraft equipment at its Edmonton base. It has repair contracts for T-33 jet trainers, Fairchild C-119 freighters, B-25s, C-47s and Harvards for the R.C.A.F., in addition to miscellaneous components and electronic equipment.

Northwest also has a contract for repairing, inhibiting and preserving aircraft by mobile repair parties at various locations across Canada from Trenton, Ontario, to Comox, British Columbia.

It was in November, 1951, that the company's modern, air-conditioned instrument-repair laboratory was opened—one of the largest such facilities in the Dominion. This laboratory overhauls and tests aircraft instruments of all kinds. The problem of obtaining highly qualified personnel for this work was solved by bringing to Edmonton from Europe a large number of fully-trained technicians.

Last year a further extension was inaugurated, in the form of an electronics repair laboratory for the overhaul and repair of airborne and ground radio equipment.

The total floor area devoted to aircraft work is now 275,000 sq ft, and 650 people are employed. President of Northwest Industries is F. G. Winspear.

Pye Canada, Ltd.

IN the choice, in 1948, of Ajax as a plant location Pye Canada had the distinction of being the first company to begin operation in an area which, situated 22 miles east of Toronto, has rapidly become a busy industrial community.

The company's operations in Canada embrace all products of the Pye Group which have market application in the Dominion. The progress of the telecommunication division has been steady, many firms connected with the aircraft industry using Pye ground communications equipment. The Department of Transport has standardized the company's equipment for airfield vehicles (having some ninety sets in operation), as also have the Calgary and Vancouver municipal airports.

A number of aerial survey companies (e.g., Spartan Air Services, Kenting Aviation, and Canadian Aero Survey) use Pye equipment in their aerial survey and mapping in outlying areas such as the Yukon and North-West Territory, having reporters in the aircraft—which are principally helicopters—and A.C. or battery fixed stations on the ground to maintain continuous communication. A P.T.C. 704 fixed station is also used by the Government's ice-breaker *D'Iberville* for communication with its helicopter.

For telephone installations Pye Canada, Ltd., represents Etelco, Ltd., of England, in Ontario, Quebec, and British Columbia, and also markets scientific instruments made by W. G. Pye, Ltd., and Unicam Instruments Ltd., both of Cambridge, England. Managing director of Pye Canada is W. Jones.

R. F. D. (Canada), Ltd.

FORMED in December, 1951, this company is a subsidiary of the British R.F.D. company at Godalming, Surrey. The factory premises are located in Granby, P.Q.; cover a floor area of 15,000 sq ft; and are devoted to the manufacture and repair of all types of air/sea rescue equipment. Overhaul and repair work on such equipment is performed for the R.C.A.F. and R.C.N.

The president of R.F.D. (Canada), Ltd., is R. E. Lloyd, and the chairman of the company is A. Van Beugen Bik.

Simmonds Aerocessories of Canada, Ltd.

THIS company serves the Canadian aircraft industry by supplying specialized instruments and components, such as the Simmonds Pacitron gauging system, a wide range of high-strength access and cowling latches, and—more recently—Hi-Shear anchor bushings and the Simmonds SU pump. Simmonds Pacitron fuel and water/methanol gauges are fitted to T.C.A. Viscounts, now in operation in Canada and U.S.A., and Load Limit Controls have been specified by this airline to facilitate precision refuelling.

New and improved Hi-Shear fasteners are available and in use on a number of aircraft now in production. In addition to exclusive Canadian rights for Hi-Shear fasteners, British manufacturers represented in Canada by Simmonds include Saunders Valve Co., Ltd., Graviner Manufacturing Co., Ltd., and King Aircraft Corporation. The company is under the management of Robert G. Huggett.

Sperry Gyroscope Co. of Canada, Ltd.

IN April this year, the Sperry company ceased being tenants and became owners of their modern, 90,000 sq ft plant on Cote de Liesse Road, Montreal, which had previously been operated by the company for the Canadian Government. Since the start of operations in 1952, over 17,000 instruments of Sperry and Kollsman type have been produced at the Montreal factory; and many thousands have been overhauled by **Sperry Gyroscope Ottawa, Ltd.**, an affiliated company. The district office at Vancouver has been enlarged, to provide for the increased requirements of customers in Western Canada.

The Lucas-Rotax plant at Scarborough, near Toronto

Products include Gyrosyn compasses for the R.C.A.F., R.C.N., T.C.A., C.P.A. and other commercial operators; and Kollsman machmeters (Sabre), mach/A.S.I.s (CF-100) and 50,000ft altimeters (Sabre, CF-100). Also relevant is the widespread use in Canada of the products of the U.S. parent company, the Sperry Rand Corporation. The A-12 automatic pilot and Zero Reader flight director are currently in use on C.P.A.'s trans-Pacific flights, and engine analyzers (electronic devices for in-flight or ground detection of engine malfunctions) are used by T.C.A. in its Super Constellations. Promising new developments are forecast in relation to the Integrated Instrument System, designed to simplify the control panels of complex modern aircraft.

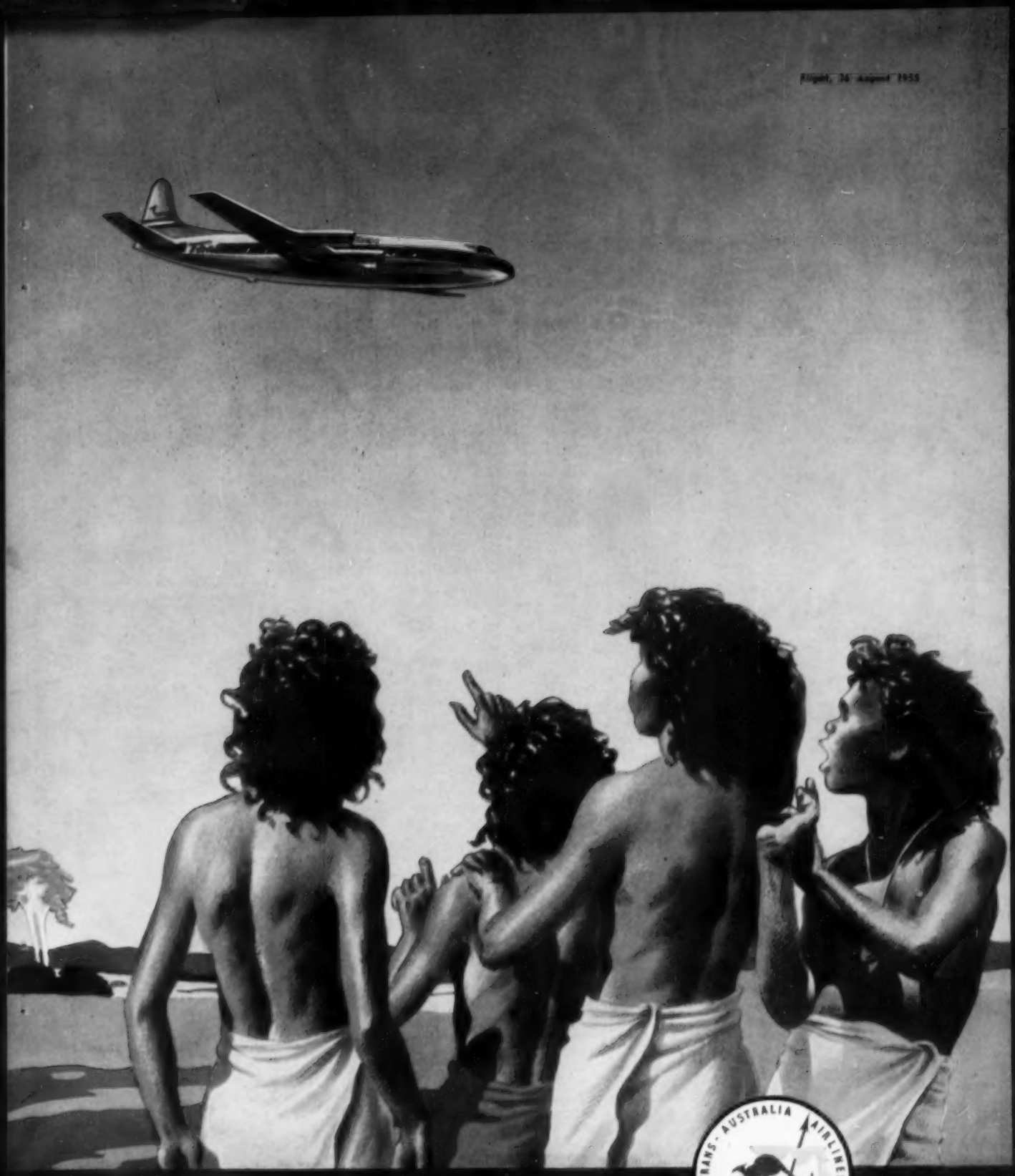
One of the most important developments at Sperry Canada during the last year has been the expansion of the engineering department at the Montreal plant to a total of 20 men, to cover the design and development of new products for both military and commercial applications. One recent development is a new controller unit for the Gyrosyn compass, which permits the use of the instrument in polar regions as a free directional gyro reference. This new installation has already been supplied in small numbers to the R.C.A.F. and civil operators—including C.P.A., for use on the polar route to Amsterdam.

Mr. B. W. King, managing director of the Sperry Gyroscope Co.

The total number of employees (Montreal plus Ottawa) approaches 800, including a large force of field service engineers. The overhaul of computing gun/bomb/rocket-sights continues to form a major programme at Ottawa.

The machinery and equipment originally in the Montreal plant remains Crown property, and the company has agreed to give priority to defence contracts in these facilities for a ten-year period. Crown-owned equipment, if used on commercial work, will be subject to a rental charge. Within this framework, the purchase by the company of the site and plant itself has certainly opened the door to a wider, more independent choice of activity. Having available the parent company's know-how, Sperry Canada's team are now confidently ready to meet Canada's needs largely by their own efforts.

Managing director of the Sperry Gyroscope Company of Canada is B. W. King.



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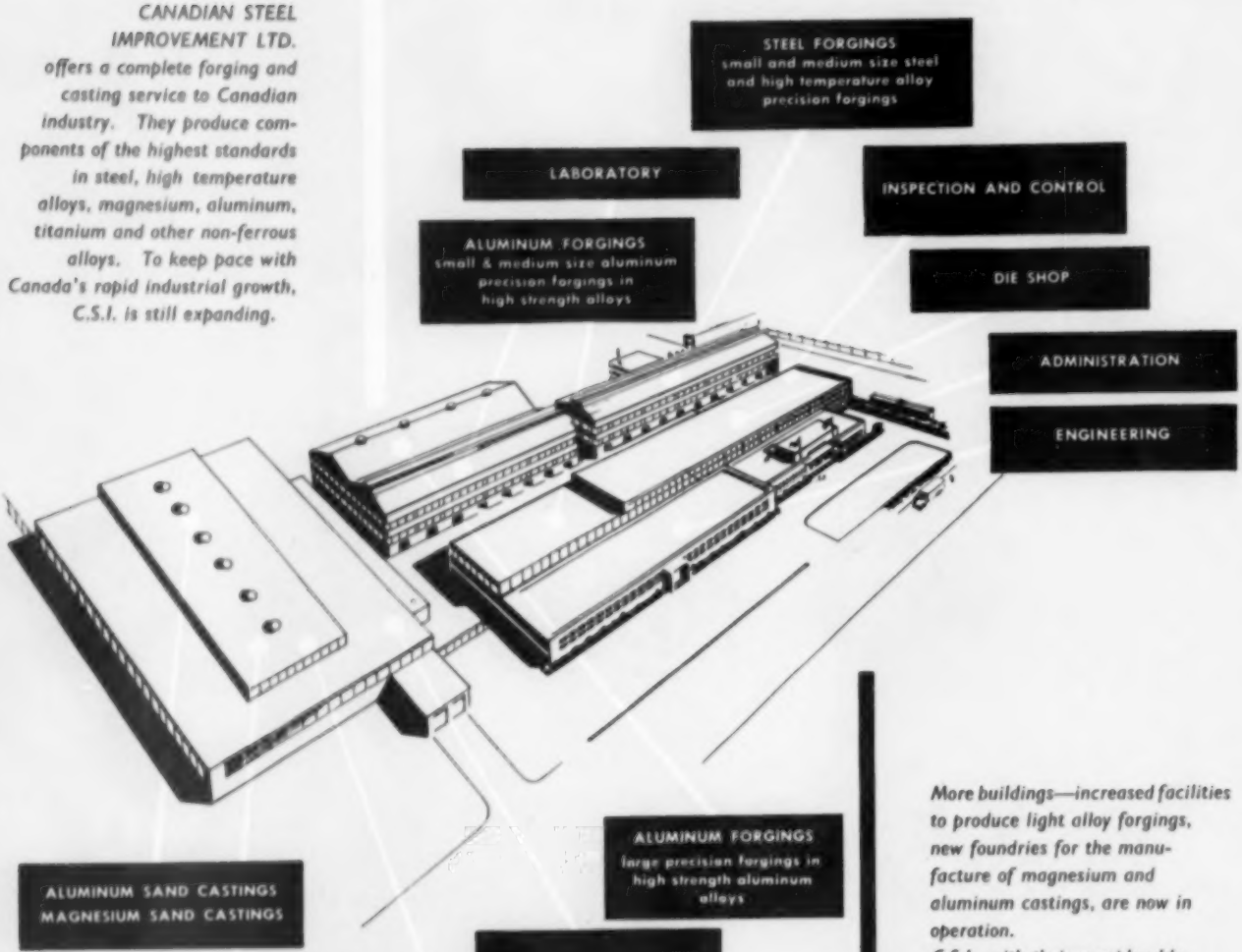

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CF-100s of the Royal Canadian Air Force

A Review of Commitments, Forces and Deployment

By

JOHN W. R. TAYLOR

COMMONWEALTH AIR STRATEGY

WRITING about Commonwealth air strategy is rather like playing the television parlour game *Find the Link*, in which a panel of "experts" has to guess the common denominator of two people with no apparent connection beyond the fact that they are both human.

There is little evidence of any common air strategy between members of the Commonwealth in this age of vast regional defence pacts. The United Kingdom and Canada are linked by the North Atlantic Treaty Organization. But Australia and New Zealand, in partnership with the United States, seem concerned only with the Pacific area. South Africa is concentrating on home affairs. India maintains a policy of uncompromising neutrality. The common aim and close co-operation—almost to the point of integration—that produced such excellent combat results in World War II seem a thing of the past.

But in fact they are by no means past. This we soon discover when we look beyond the maze of abbreviations that spell international co-operation. NATO, ANZUS, ANZAM, and the unpronounceable designations given to their commanders, represent only a small part of the overall picture.

Royal Australian Air Force Avon-Sabres of the Sabre Trials Flight at Williamstown, New South Wales

In the case of the Royal Air Force, the only operational units directly under NATO command are the fighter squadrons of the 2nd Tactical Air Force and their associated control and reporting organization on the Continent, plus some Canberras of Bomber Command available to 2nd T.A.F. on a day-to-day basis.

In wartime, obviously, the Shackletons, Neptunes and Sunderlands of Coastal Command would form an important part of the forces at the disposal of the Supreme Allied Commander Atlantic (SACLANT). Bomber Command, too, might be called upon to operate in tactical support of NATO forces in Europe, or to divert part of its immense offensive power to the sea battle. But, in general, the Home Commands of the Royal Air Force are quite independent of NATO and are available constantly to meet other commitments.

This is where we begin to find the common denominator, because the Royal Air Force has three major commitments and they are shared to a large extent by the other air forces of the Commonwealth. In suggested order of priority they are: 1, Home defence; 2, Commonwealth defence; 3, International treaty obligations (excluding UNO, which, because of its universal membership, does not involve normal strategic planning).

Each makes its own demands in terms of equipment, organization and planning. Yet, if the air forces are to be effective, they must also be capable of fitting together, like the pieces of a jig-saw puzzle, into a single overwhelmingly important pattern of global strategy.

However vague our notions of that strategy may be, we know that it depends principally upon the use of air power. We can go further and say that the whole philosophy of Western defence hinges on the deterrent power of U.S.A.F. Strategic Air Command and R.A.F. Bomber Command. There is no effective defence against the high-flying, high-speed atom-bomber. That deterrent is our best hope of averting a major war, and our only hope of winning one if it *should start*.

In effect, therefore, the heavy bombers of the Royal Air Force, which may be supplemented later by similar aircraft operated by the Royal Australian Air Force, form the basis of all our strategy, whether for home, Commonwealth or international defence. Long-distance training and goodwill tours by shorter-range Canberras have shown that a modern jet-bomber force possesses the mobility needed to meet these varying commitments. As a result, a force of V-bombers based in the United Kingdom could be made available to defend any part of the Commonwealth within 24 hours' flying time.

Even making allowances for development in flight refuelling, in which Bomber Command is increasingly interested, the key to such mobility is availability of air bases on all important air routes between major countries of the Commonwealth. It is in the maintenance of these vital lines of reinforcement and supply that we have the first major proof that an overall Commonwealth defence strategy exists at the present time.

It would be difficult to quote the precise terms of this strategy,

COMMONWEALTH AIR STRATEGY . . .

North Star of Royal Canadian Air Force Air Transport Command

because there are no formal defence pacts between nations of the Commonwealth; and, indeed, they are not needed. But Britain's policy of maintaining strong defence forces and bases throughout the Middle East, on the air routes to India, Malaya, Australia, New Zealand and Hong Kong, is proof of its existence.

Withdrawal of R.A.A.F. and R.N.Z.A.F. squadrons from Malta and the Middle East seemed to reflect a lessening of co-operation with the R.A.F. But this will be more than offset by Australia's growing contribution to the defence of Malaya. From the logistical point of view, it is obviously better to have R.A.F. squadrons in Malta and R.A.A.F. squadrons in Malaya than *vice versa*.

Then, again, there is no better proof of Commonwealth co-operation than in the way training facilities are shared. There is no vast Air Training Scheme of the kind that existed during the war; but hundreds of R.A.F. pilots and navigators are trained by Canada each year, at no cost to the home country, and men from almost every part of the Commonwealth can be found at Cranwell, the R.A.F. Staff College and other training centres in Britain. Nor is this mutual aid confined to training. The commanders and senior officers of some Commonwealth air forces are R.A.F. officers detached for the duty. A good example is found in the comparatively-new Royal Ceylon Air Force, which is commanded by G/C. G. C. Bladon, and has the assistance of an R.A.F. training team. At the moment it is little more than a training organization, but by contributing to its own defence it is easing the commitments of the larger Commonwealth Air Forces.

Mutual aid on the equipment side was demonstrated by the gift of 375 Canadair-built Sabre F Mk 4 fighters to the R.A.F. by Canada and the United States. Co-operation in technical development is typified by the rocket range at Woomera [see pages 318-320], which is a joint U.K.-Australian venture.

All these things show that there is very real co-operation within the Commonwealth for mutual defence; even though the present emphasis seems to be on home defence and international commitments. So long as the threat of the strategic bomber is sufficient to avert a major war, there is unlikely to be any significant change of policy. Chief tasks of the air forces will be to deal with limited wars of the Korean pattern, and to perform colonial "police" action, as in Kenya, whilst always being prepared for the "real thing." This involves finely-calculated division of effort between each commitment and the example of the Royal Canadian Air Force is typical.

Canada promised to send 12 squadrons of single-seat fighters to Europe as part of its contribution to NATO. It has done so and, thanks to its thriving and efficient aircraft industry, has also supplied Sabres to the R.A.F. and U.S.A.F., and both Sabres and T-33 Silver Star jet-trainers to Greece and Turkey. Yet it has an immense home defence problem now that both Russia and America have been thinking in terms of trans-polar air attacks, on routes which would pass over Canadian territory.

Inevitably, this calls for close co-operation with America, and it is reported that Canada's Air Defence Command may soon be operating under a joint U.S.-Canadian command, headed by an officer from either country. This would not constitute a merger, but would be aimed solely at improving the operational efficiency and economy of available fighter defence forces. Nor would the benefits be one-sided, for the R.C.A.F. already has nine squadrons of CF-100 all-weather fighters in service for home defence, and will form three more if its current recruiting problems can be solved.

Canada is also responsible for much of the work of building up the radar chains that will provide early warning for the defence forces of both nations. Following reconnaissance by No. 408 (PR) Squadron, construction is now well under way on the Mid-Canada Line, with helicopters of No. 108 Communications Flight, R.C.A.F., playing a prominent rôle in transporting equipment and components for the radar chain. [See article on page 317.]

Nor is that all, for Canadian maritime reconnaissance squadrons, whose Lancasters are due to be replaced eventually by Canadair CL-28 modified Britannias, offer anti-submarine protection to the country's eastern seaboard; and R.C.A.F. Transport Command is especially active, maintaining, among other services, one across the Atlantic to the U.K. and the European-based R.C.A.F. Sabre wings.

There is little need to comment on NATO strategy in Europe. Main Commonwealth contributions, as already mentioned, are R.C.A.F. wings of the 4th T.A.F. and the R.A.F. fighter squadrons of the 2nd T.A.F., equipped with Venom fighter-bombers, Meteor N.F.11s and Sabres, which are gradually being replaced by Hunters.

In addition, R.A.F. Air H.Q. Malta enters into the picture of NATO strategy in the Mediterranean, because its A.O.C., Air Marshal Sir Brian Reynolds, K.C.B., C.B.E., is also Deputy Commander-in-Chief (Air) Allied Forces Mediterranean. Present R.A.F. strength in Malta consists only of Shackleton maritime reconnaissance squadrons and a Meteor night fighter squadron, some of which form part of the NATO forces. But Malta has lost little of its old strategic importance in peace and war.

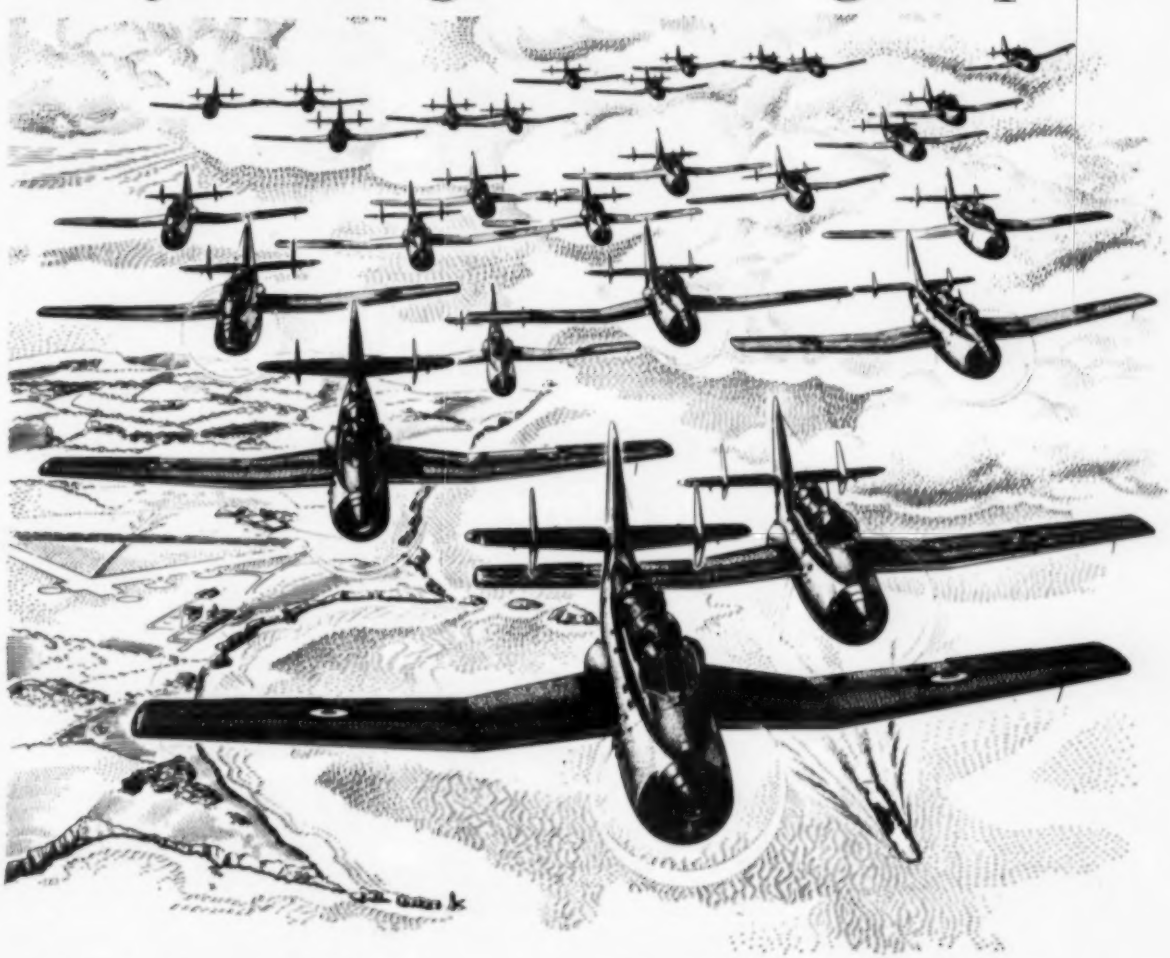
Moving farther east, there have been big changes in the past year as a result of Britain's withdrawal from the Canal Zone and accession to the Turkey-Iraq Treaty.

The R.A.F. Middle East Air Force has been divided into two regional groups under the command of Air Marshal Sir Claude Pelly, who has his H.Q. in Cyprus.

The northern group, Air Headquarters Levant, centred on Nicosia,

A Neptune of No. 11 Squadron, R.A.A.F., at Singapore during a recent air/sea exercise

More Gannet Squadrons are forming according to plan



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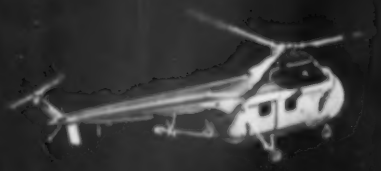

operators

use

WESTLAND HELICOPTERS

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COMMONWEALTH AIR STRATEGY . . .

Pupils of the Royal Rhodesian Air Force examine a Provost, their standard basic trainer.

Cyprus, will control R.A.F. units in Iraq, Jordan, Cyprus, and Libya and will be responsible for R.A.F. interests in Egypt when withdrawal from the Canal Zone is complete. Its main task, obviously, is to protect air bases in the Middle East which would be vital to Commonwealth communications and reinforcement in time of war.

Although Habbaniya is no longer an R.A.F. base, British aircraft are able to use it much as they please. In return, Britain has obligations to help defend Iraq. Jordan, too, is assured of British military aid if attacked, and a Venom squadron is based permanently at Amman, with a further base available at Mafrak. These treaty obligations are by no means mere scraps of paper, for there is still very real danger of trouble between Israel and the Arab states.

The southern half of the Command—Headquarters British Forces, Aden—controls R.A.F. units in Aden Colony and Protectorate, along the South Arabian coast, in Kenya and the Sudan, and is responsible for the Persian Gulf staging posts of Bahrein and Sharjah.

This also is no sinecure. Easing of the situation in Kenya has made it possible to withdraw R.A.F. bombers, leaving only Harvards to support the land forces dealing with Mau Mau. But the border dispute with Yemen has called for considerable "police" action in the past months by the Venoms, Vampires and Valettas of the air forces, which are being supplemented by an armoured car squadron manned by Aden Levies, under officers of the R.A.F. Regiment.

The R.A.F. has been engaged in this kind of "colonial warfare" for more than 30 years, and will probably have to carry on the spasmodic fighting so long as air bases are needed in this part of the world.

Until recently, its burden in the Middle East was shared by the R.A.A.F. and the R.N.Z.A.F.; but it is now alone. South Africa might be expected to show an interest in the defence of the area, which is the "gateway to Africa," but is more concerned with home problems. It has no regional treaty obligations, and the South African Air Force is therefore, to all intents and purposes, a home defence force. Purchase of Canadair-built Sabres will strengthen its intercepter and ground attack wings, and it would be able to play some part in maintaining Commonwealth sea communications in wartime with its Shackleton 3s. But, otherwise, the S.A.A.F. appears to have little part in overall strategy.

The Royal Rhodesian Air Force, commanded by A. Cdre. E. W. S. Jacklin, is in much the same position, although its problems are perhaps less acute. With an ultimate objective of two ground-attack fighter squadrons and one transport squadron, it is at present concentrating on training, using the same Provost-Vampire sequence as the R.A.F. A later batch of 12 "Armed Provosts" will double as both trainers and highly effective support aircraft for "police" actions.

Although concerned mainly with home defence, the R.R.A.F. is also responsible for aerial survey work, for which it uses Dakotas and Pembrokes; communications, with Pembrokes, Ansons and Rapides; and flying doctor/air ambulance services to clinics in the native reserves with Harvards, Austers and Rapides. Although apparently of only local value, such services have an international importance in that they contribute to internal stability.

More critical than even the Middle East at the present time is the situation in the Far East, where the trouble in Malaya is only one of a complex series of defence problems.

Assorted treaties promise mutual aid in the event of armed attack on any of the signatories; but this is an area where local wars are far more likely than full-scale ones, and the problem of preventing further Communist infiltration is acute.

R.A.F. effort is concentrated in the Far East Air Force under the command of Air Marshal Sir Francis Fressanges, who has his headquarters at Singapore, with Air Headquarters in Malaya, Ceylon and Hong Kong. The main task is, of course, the bandit war in Malaya, which could hardly have been fought without the aid of the transport and supply-dropping Valettas, and the Pioneers and helicopters of the R.A.F. and Fleet Air Arm. Fortunately, Australia and New Zealand have accepted the fact that the front line of their defence is in Malaya, and No. 1 (Lincoln)

(Left) Maintenance of Attackers of the Royal Pakistan Air Force. (Right) Preparing for a flight in a Vampire T.11 of the Royal Rhodesian Air Force

COMMONWEALTH AIR STRATEGY . . .

A Sea Fury of the Royal Canadian Navy, part of the fighter strength of H.M.C.S. "Magnificent."

Squadron of the R.A.A.F. and Nos. 14 (Venom) and 41 (Bristol Freighter) Squadrons of the R.N.Z.A.F. are supplementing the R.A.F. Vampires, Venoms, Canberras and other types.

The Lincolns have done particularly valuable work in the jungle war, and will be joined next year by two R.A.A.F. fighter squadrons, to complete Australia's contribution to the strategic reserve in Malaya under the ANZAM agreement between the U.K., Australia and New Zealand.

The other South Pacific treaties are more formal, and of less immediate import. The S.E. Asia Collective Defence Treaty was signed by the U.K., U.S.A., France, Australia, New Zealand, Pakistan, Thailand and the Philippines, who have set up a joint planning organization to co-ordinate defence efforts in the area. ANZUS is basically a political guarantee of help to Australia and New Zealand, by America, in the event of war. It is a great comfort to these countries because, despite 500 m.p.h. communications, they are still further away from their most powerfully-armed friends than from some potential enemies.

The Royal Pakistan Air Force, although committed to the S.E. Asia pact, is basically a home defence force, as is the Indian Air Force. A glance at the map of air routes to Australia and the Far East will underline the importance of maintaining the *status quo* in these countries and, provided they remain defensive, their air forces will support Commonwealth strategy even if they never venture beyond their national boundaries.

This brief outline of Commonwealth strategy and deployment is, therefore, complete except for one of the most vital aspects of all—the maintenance of sea communications. This is no place to argue the relative merits of ship-based and shore-based anti-submarine aircraft. Suffice it to say that those responsible for Western defence continue to see a place for the aircraft carrier in their overall plan.

What is certain is that the Commonwealth will depend on seaborne supplies for its survival as much in any future war as in the past. To protect the ships carrying those supplies, the Royal Navy has in commission ten carriers, the Royal Canadian Navy one (with another building) and the Royal Australian Navy one, with a second fitting-out. The aircraft that equip them are at least as good as their counterparts with any other Navy and, despite the critics, there can be no doubt that the carrier conforms perfectly with the two basic requirements of present-day global strategy—economy of force and mobility.

SALVAGE FROM AN ICE-FLOE

THE DC-4 that made a forced landing on an ice-floe in Hudson Bay was recently on its way back to its base in New Jersey, after one of the more unusual episodes in the history of salvage.

The operations involved using canoes and a motor boat to tow the aircraft through 60 miles of ice-floes to shore, complete with the floe that had served it as an emergency landing strip; the ice-floe was kept from melting with hay and sawdust dropped from a DC-3; and daily hot meals were delivered to the salvage crew by helicopter from the airfield at Port Churchill, 60 miles away across broken sea ice.

It all started when a DC-4 of United States Overseas Airlines ran out of fuel over Hudson Bay. The pilot picked out what looked like the smoothest floe, about four miles long by half a mile wide, and attempted to put down. Partly because of the strange tricks played by light in the Arctic, an apparently smooth floe can, in fact, be anything but smooth, particularly when seen from the air. So it was with this particular "flat" of ice. It was straddled with ridges of broken ice fifteen feet high. These tore off the landing gear, twisted the starboard wing, and wrecked the nose. But there were no casualties and the crew was rescued. Opinion in Port Churchill was that the aircraft would have to be left to drift until the ice carrying it disintegrated; and this was also the view of the insurance companies, which paid full compensation, $600,000, selling the salvage rights back to the airline for a paltry $5,000.

Meanwhile a salvage crew was delivered to the ice-floe by helicopter. A DC-4 was despatched with fifteen pontoons, weighing a third of a ton each. Shoved out of the cargo doors at 130 m.p.h., the pontoons hit the ice like five tons of bricks, bounced three feet in the air and skidded across half a mile of pressure ridges, in the process splitting the ice floe. Next, men and sledges were despatched to haul the pontoons back to the "wreck" (which took two days) and get them under it in case changes in wind direction broke up the floe.

At this time, too, a DC-3 had taken off from Churchill airfield with the first of 45 tons of hay and sawdust. This was dropped around the casualty in an area about 300 feet square, and it served its purpose, for the ice it insulated was still more or less buoyant several days after the surrounding ice had broken up, or grown porous and sunk.

Meanwhile the "canteen helicopter" continued to make its daily flights to the floe with hot food, and a small party under the leadership of one John Voisey (if I remember correctly, a one-time, one-legged trapper of Eskimo stock) was on his way through the ice floes with three canoe-crews and a Peterhead, which is a boat some 45ft long used for coastal freighting throughout the Canadian North. Their purpose was to tow the ice-floe, and its load, the 60 miles to Port Churchill.

All that remained of the floe by the time Voisey's flotilla reached it was that part covered with sawdust and hay. Next day the ice disintegrated, slowly sank and left the aircraft sitting comfortably on the pontoons.

Hudson Bay is subject to sudden violent storms; to ice-haze and blankets of fog. It was now four weeks since the crash landing, during which time the weather had been comparatively kind. But it seemed unlikely that the weather would remain kind for the three weeks necessary to tow the aircraft to Port Churchill. However, there were more pressing worries.

The Peterhead's engine broke down. The radio in the DC-4 was still working, and the salvage men—Eskimo and "white"—climbed on to the (by now) sodden ice, pulled up their canoes and awaited the delivery of replacements. These arrived by Piper Cub.

Eight days later the little party anchored off the beach at Port Churchill and the DC-4 was hauled up on to a slipway for dismantling. Port Churchill is at the head of a Canadian National Railway spurline, and the dismantling was necessary in order to load the aircraft on to C.N.R. cars for the journey back towards its base in New Jersey.

And what, it might be asked, was a transport of a United States civil airline doing flying over Canada's "Eastern Arctic" waters? Hush! It was part of the U.S. airfleet that has been delivering supplies to the new DEWline radar chain [see opposite page.—Ed.]; and it is not the only one to have suffered an unusual experience since the first of the airlift took off for the Far North last May.

FRANK ILLINGWORTH.

Twenty of the U.S.A.F.'s vast C-124 Globemasters—each capable of carrying more than 20 short tons at a time—are being used in the remarkable DEW-line constructional operation in Northern Canada and Alaska.

RADAR-CHAIN AIRLIFT

EARLY in 1954 the governments of Canada and the United States made a joint announcement of plans to establish a second early-warning radar system north of the already operational Pinetree Chain. Roughly following the 55th Parallel, it was to be known as the Mid-Canada Line. Preliminary work began almost immediately, with the R.C.A.F. playing a major rôle, and construction is in full swing.

And now this gigantic network, which will protect the whole of North America, is being completed by the construction of the distant early warning line, generally known as the DEWline (Distant Early Warning line). Whereas the cost of the Mid-Canada Line is being borne by Canada, the United States Government has assumed financial responsibility for the DEWline.

For security reasons little can be said about the location of the DEWline, but it could be described as roughly skirting the Arctic Circle from Alaska to Greenland and it is believed to be some 3,000 miles long. Though the approval of the Canadian and United States Chiefs of Staff was only given in December of last year, progress during the past six months with the project has been phenomenal. Canadian and United States aircraft, both Service and civil, have already completed Part 1 of the most spectacular operation since the Berlin airlift—the delivery of 22,500 tons of constructional equipment across 2,000 miles of barren Arctic territory to sites at intervals along 3,000 miles of ice-fringed coastline. Phase 2—the construction of airstrips—is now in full swing.

In general, the procedure for opening-up each site has been as follows. The first step in each case was to make a rudimentary landing strip. In some places, men and equipment had to be parachuted in; in others, where sea or lakes still frozen last spring could be utilized, the "bush planes" which for years have performed a great variety of duties in northern Canada were pressed into service. They carried men with light equipment and blasting explosives. Organizing local—Eskimo—labour, these men then prepared airstrips sufficiently long to accept the ubiquitous Bristol Freighters. Within hours of a strip being made ready, a Freighter would arrive with heavier equipment, the main item of which was usually a bulldozer. This powerful machine was at once put to work on extending the strips sufficiently to accept C-124 Globemasters, and these big machines are now ferrying in the building materials and radar equipment which will go to make the chain.

Altogether, some 140 transport aircraft are operating from three main bases, each nearly 2,000 miles from the more northerly points of the DEWline.

The operational base areas are divided into two sections, designated the central and eastern sectors. In the central sector the Canadian commercial carriers are concentrated under the control of Canadian Pacific Airlines and Associated Airways, and use Edmonton Airport, Alberta, as a distribution point. In addition, a U.S.A.F. squadron of Globemasters was assigned to the job of handling heavy equipment in the eastern sector. The civil operators were marshalled under the direction of Maritime Central Airlines of Charlottetown, the primary civil contractors.

The following details give some idea of the variety, both in size and ownership, of the aircraft engaged.

The United States Air Force—Twenty C-124 Globemasters.

Royal Canadian Air Force—One squadron of C-119 Packets, plus various Dakotas, Mitchells, Otters and Beavers. Canadair C-4s of No. 426 Squadron are sometimes used in support.

Associated Airways, Ltd.—Operating Avro Yorks and DC-3s from their home base at Edmonton.

Pacific Western—DC-3s and C-46 Commandos.

Canadian Pacific Airlines—DC-3s.

Spartan Air Services, Ltd.—Three famous World War II types, now being used on the project for photographic survey work—Lockheed Lightnings, B-17 Fortresses and (photo page 280) D. H. Mosquitoes.

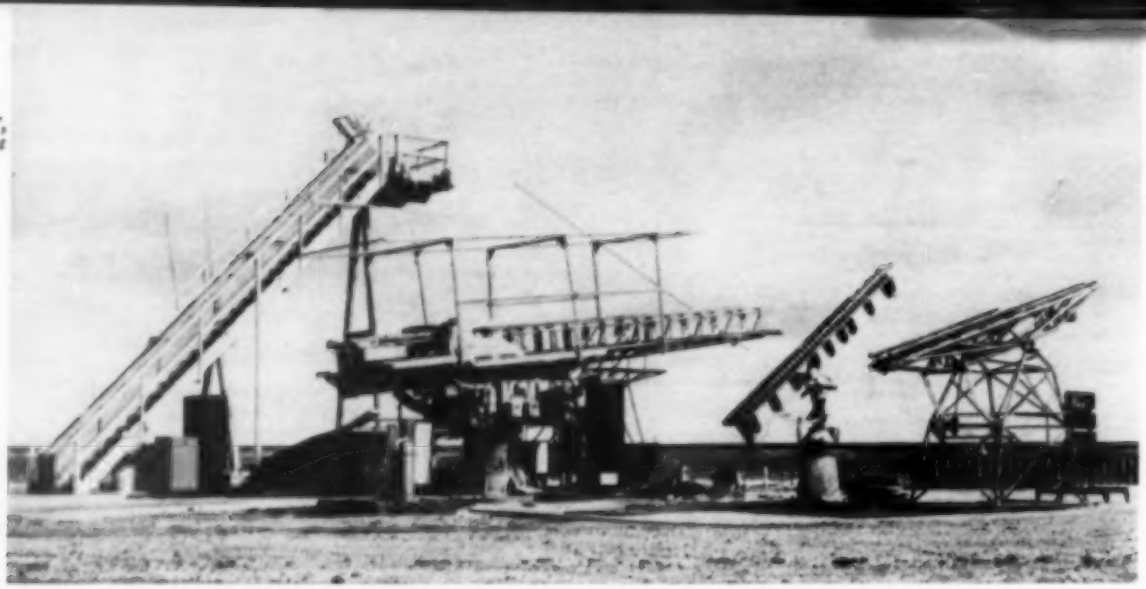
Not all the transport work, of course, is being done by aircraft. During the past few weeks 117 cargo ships have been making their way towards the Arctic coasts, carrying heavy building material and 3,000 specially trained American troops. A statement by the U.S. Army last week, saying that this armada was carrying material to "more than 50 radar stations and bases" was the first official hint as to the numerical strength of the chain. It was also disclosed that seven radar stations on the western flank of the DEWline, in Alaska, are already operating, while others are complete in Greenland. The present operations will fill in the "gap" across the top of Canada.

Whereas the maintenance supply-lift to the Mid-Canada Line, when it is completed, will be shared by the R.C.A.F. and Canadian bush airlines, the U.S.A.F. will participate in the maintenance of the much more distant DEWline until Canadian air strength is sufficient to take this over, too.

In time, no doubt, the airstrips now being constructed for the mid-Canada line and the DEWline will be used towards the industrial development of Arctic Canada, just as the once secret American air bases at Thule and Sondre Stromfjord, in Arctic Greenland, now serve the new Europe - to - the - Pacific air services; and these new radar lines will also aid the trans-Arctic civil air services of the future, just as existing military radar stations are serving the new Scandinavian Airlines services between Copenhagen and Winnipeg (*via* the Arctic) and the newer Canadian Pacific Amsterdam - Vancouver - Antipodes schedules across the Polar regions. And so a spectacular undertaking, born in the fear of aerial attack, may soon help towards the development of vast new territories.

FORTHCOMING EVENTS

Aug. 15-26. Commonwealth Survey Officers' Conference, Cambridge.
Aug. 17-27. Model Engineer Exhibition, New Horticultural Hall, London.
Aug. 27. Aircraft Golfing Society: Founders' Cup, Stoke Poges.
Aug. 27. R.N.A.S. Anthorn, Cumberland: Air Day.
Aug. 29-Sept. 4. Riviera dei Fiori Aero Club: Rally and "Caravance Riviera des Fleurs."
Sept. 3. Leicestershire Aero Club: Air Display.
Sept. 3-5. U.S. National Aircraft Show, Philadelphia.
Sept. 5-11. S.B.A.C. Show, Farnborough (Public Days, 9th, 10th and 11th).
Sept. 5. S.L.A.E. Main Lecture: "Engineering Aspects of Test Flying," by C. F. Bethwaite, B.Sc., and W/C. P. Brown, R.A.F. (Retd.).
Sept. 8. Helicopter Association: Annual Dinner and Lecture—"Design, Development, Production and Servicing of Rotor Blades," by R. Allen Price.
Sept. 12-18. Battle of Britain Week.
Sept. 19-23. Institute of Metals: Annual Meeting, Buxton.
Sept. 23. Yorkshire Aeroplane Club: Annual Ball, Harrogate.
Sept. 24. Aircraft Golfing Society: Brown Bros. (Aircraft) Trophy.
Sept. 25. St. Albans Model Aero Club: All Britain Model Aircraft Rally, Radlett Aerodrome.
Oct. 7. Helicopter Association: "The Control of Helicopter Rotor Vibration," by P. R. Payne.
Nov. 11. Helicopter Association: "Design of Helicopter Operating Sites," by H. T. Hough, M.I.C.E., M.I.Mun.E., M.T.P.I.
Dec. 16. London Airport inauguration by H.M. the Queen.



The variety of launchers on the Range "G" apron gives a clue to the variety—especially in size—of weapons tested.

AT WOOMERA

The Weapons Research Establishment, South Australia

BY its very nature, the work of Australia's Weapons Research Establishment must remain secret, details only being released piecemeal—if at all—as and when equipment techniques become obsolete. So little has been published about the project that, even after several years' operation, very little is generally known about its magnitude. A good idea of the scope of the installations at Salisbury and Woomera is, nevertheless, given by the following official account, specially prepared in Australia for this Commonwealth Number of "Flight."

SINCE the Australian range area was first surveyed in 1946, vast strides have been made in the establishment of comprehensive joint United Kingdom/Australian guided-weapons research and development facilities. The base is at Salisbury, 15 miles from Adelaide, and operations are conducted from a rangehead near Woomera, 270 miles to the north-west.

The major purpose of the Weapons Research Establishment is to provide facilities for, and to co-operate in, research and development on guided weapons. The projects are in the main initiated by the United Kingdom, but work is also in progress on projects conceived in Australia.

Because of the extent of the undertaking, the work has been divided between the two countries broadly in accordance with respective resources. The United Kingdom, with highly developed research and development organizations and extensive manufacturing and financial resources, has, in general, undertaken the development of the prototype weapons. The primary contribution of Australia, whose geographical features are a unique asset, is the provision of the facilities for testing the weapons and for analysing the test data.

Salisbury: The main establishment.—To perform these tests much preliminary testing and background work are necessary, and extensive supporting facilities (more extensive, in fact, than the actual range installations themselves) are required. These have been set up in Salisbury in existing buildings of very satisfactory type, built in connection with an explosives establishment during World War II.

A considerable amount of work has been done on the buildings to fit them out as laboratories, workshops and other special-purpose departments. A large number of buildings of extensive floor space has been (and still is being) modified and equipped to provide weapon-preparation facilities for the various United Kingdom contractors. These buildings are on a site seven square miles in area, which was already developed with roads, power, water supply and other services and is within reasonable daily travelling distance of a main centre of population and shipping port, namely, Adelaide. Proximity to this large city has proved a most important asset, for as the undertaking has developed there has been a continuously growing demand for skilled staff, materials and services which could not otherwise have been met.

The policy of the Department of Supply, which controls the

A still-growing village of some 500 bungalows houses Woomera's technicians, Service personnel and other workers.

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in which a young man will have satisfied his need for action and will be enjoying the security of a well-paid career

There is excitement, exhilaration, in the lift and thrust of jet flying. There is also a deep and lasting satisfaction, known only to those who fly. Ask these men to describe it and words fail. Ask them to give it up and they worry. For once you have shared the tranquillity of that new world above the clouds, you cannot easily forgo it.

Many young men dream of joining this brotherhood of flight. They sense the magic. They see that the future of mankind lies in the air and want to help fashion that future.

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These men can realise their dream. They have within their grasp the chance of a lifetime of exciting and satisfying work. With the Royal Air Force, pilots and navigators fly often. They fly far afield. And they manage some of the finest machines in the world: Canberra, Valiant, Hunter — these names are but the prelude.

"But there's more to a life than flying" you may say. The Royal Air Force knows this and has planned accordingly.

Aircrew do much more than fly. They are often seconded for important work in Britain and abroad.

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Training others, international liaison, scientific exploration—these are but a few of the diverse and important missions to come the way of aircrew personnel. And the new Direct Commission scheme provides the opportunity to make the Royal Air Force a career.

You can now join, as an officer, with the certainty of a continuing and satisfying job until you retire with a pension. Or you can choose, if you wish, a twelve year commission, with the option of returning to civilian life after eight years. In this case you return with a handsome tax-free gratuity, far more than you are likely to save in a similar time in any other profession. Pay, as you rise in the service, is equally realistic. A Flight-Lieutenant of 25, drawing full allowances, can now earn more than a thousand a year.

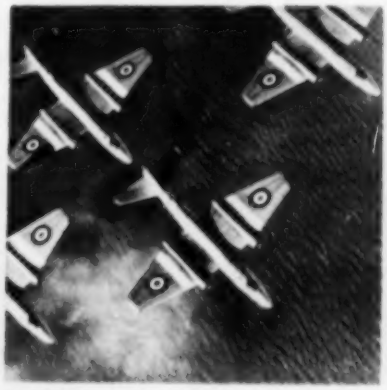
Sporting facilities in the R.A.F. are good and convenient and there is leisure to enjoy them. Travel, too, is routine, accepted and enjoyed as one of the perquisites of a vital job. It is right that this should be so. These men are our first line of defence. They are the heirs of "the few".

How to fly with the R.A.F.

Because their opportunities are great and their work important, standard of entry for aircrew is very high. Education to at least the level of the General Certificate of Education, Scottish Leaving Certificate or their equivalents, perfect physical health, aptitude as well as enthusiasm for flying — to these must be added the ability and personality to lead others. You must also be between 17½ and 26. If you have these qualifications you have the chance of a career that is both rewarding and worthwhile.

Write at once for further details of the schemes of entry and for an interesting, informative booklet on flying with the R.A.F. to the Air Ministry, (F.R. 302), Adastral House, London, W.C.1. State date of birth and educational qualifications.

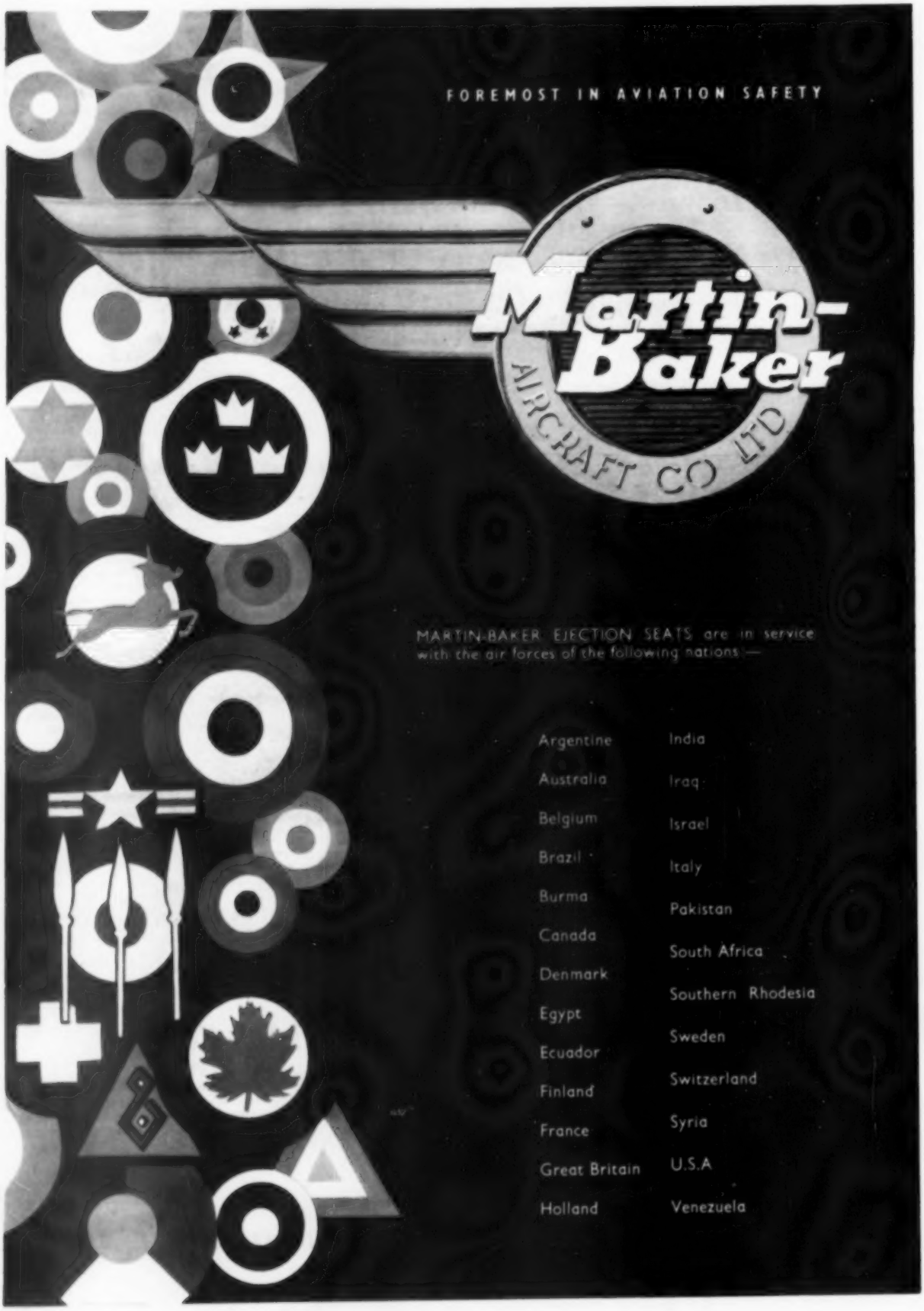
RESPONSIBILITY. Pontoons at Young Sound, Greenland, carrying stores to a Sunderland of R.A.F. Coastal Command, during the British North Greenland Expedition. A share in such exciting missions is a likely part of every pilot's and navigator's future.



REWARD. Training to fly with the R.A.F. is exacting . . . and rewarding. It leaves you highly skilled and self-reliant, able to meet the challenge of the skies. Here, Canberra T 4 jet trainers fly in formation.

AND RELAXATION. Yachting is a popular R.A.F. pastime. Near the Baltic it's ice-yachting and gliding: across in Canada, fishing, winter sports. Wherever you go with the R.A.F. your sporting horizon expands.

The Royal Air Force *Flying ...and a career*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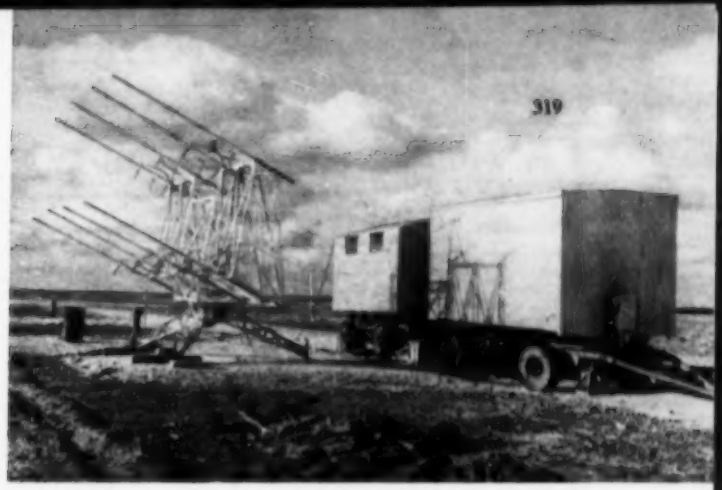


(Left) One of the basic types of test vehicle—known as R.T.V.1—is launched. (Right) Missile-tracking radar, operating on the Doppler principle.

AT WOOMERA . . .

Weapons Research Establishment, is to locate as large a part of the facilities as possible in Salisbury, so as to keep to the minimum the number of people required in the more costly environment of Woomera. The cost of maintaining staff at Woomera is roughly 2½ times that of keeping them at Salisbury. In addition, although transport to Woomera is well developed, the physical difficulties of maintaining a large community there are great, and the isolation from manufacturing, supply and other resources of Adelaide would be a serious handicap. The establishment of the undertaking in Salisbury has been accompanied by great progress in the surrounding district generally. Housing and other amenities have been set up, and there has been a big increase in population. New industries have been established, and recently the South Australian Government has chosen an area nearby for the site of a large satellite town to be built progressively over the next ten years.

The technical work done under the joint undertaking at Salisbury falls generally under four headings: trials and instrumentation, engineering, administration, and air support (R.A.A.F.).

The trials group deals with the planning and conduct of trials. Planning includes the arrangement of installations required for carrying out the trials, and of the necessary instrumentation. A mathematical services section converts the data recorded in the trials—obtained mostly from photographic film or magnetic tape—to usable graphical and numerical forms, and analyses the information so obtained. To alleviate the vast amount of routine hand work involved in reading and converting the raw data from the ranges, numerous data-reducing machines are in operation. For analysis and computation, punched-card machinery is in use at present, but it will shortly be replaced by an electronic digital computer made by the English firm of Elliott Brothers (London), Ltd.

The instrumentation group develops and provides the vast range of electronic, optical and other types of instruments for use in the trials. Many of these have to be automatic in operation and of quite novel design to suit the specialized needs which constantly arise.

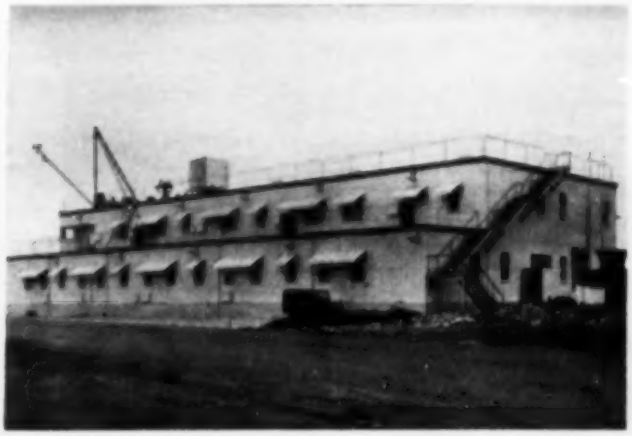
The engineering group administers the drawing office and industrial section of the Establishment. Extensive, well-equipped workshops are maintained at Salisbury, capable of undertaking the wide variety of work necessitated by the nature of the undertaking. The engineering group is also responsible for such matters at Woomera.

The air support is provided by the Royal Australian Air Force component of the Weapons Research Establishment. Initially based at Mallala, 40 miles from Adelaide, it has now been transferred to Edinburgh Airfield, built specially for the purpose at Salisbury. Operations are also conducted from airfields in the Woomera area. The R.A.A.F. component, besides being responsible for all the flying facilities for weapons trials, operates and maintains all pilotless target aircraft, including the Australian Jindivik.

The work of the Weapons Research Establishment is also supported by various organizations outside the Department of Supply. The R.A.A.F. has already been mentioned; in addition, both the Army and the Navy contribute personnel. The Department of Works undertakes all construction work, including electrical supply and wiring, water supply, sewerage, etc.

Home on (or near) the range—a brick-built house in the village.

(Below) Instrumentation building, Range "E". (Below, right) Test shop No. 4 on the same range.



AT WOOMERA . . .

Situated within the technical area at Salisbury are the buildings which accommodate the representatives of the British firms engaged in the development of guided weapons and their components. The firms are, of course, the "customers" of the Weapons Research Establishment. From them flow the test vehicles and weapons to be test-flown at the ranges. A large number of buildings of extensive floor area has been made available rent-free to the various firms for offices, workshops, and laboratories, and they have been converted by the Government, adapted, and provided with services such as electricity and water. Items for which the firms are responsible are installation of machine tools and plant; provision of stores and materials; development, assembly, workshop testing and modification of the weapons; staffing; and overheads.

More than a dozen British firms are accommodated at Salisbury at present. Weapons and components, and various items of associated equipment and apparatus, are brought by air or sea to Edinburgh Airfield, or to Port Adelaide, and thence by W.R.E. transport to the firms' workshops at Salisbury for checking and assembly. Later, of course, they are transported to Woomera, where the firms have further facilities for pre-flight checking and preparation for firing.

Woomera and the Ranges

Active construction at Woomera began in 1947, and is still in progress. Early efforts were directed mainly towards provision of the basic services such as housing, water, sewerage, roads, power, airfields and the more essential technical requirements for the trials of that period. More recently, the programme has consisted mainly of construction of the technical facilities required for individual weapon projects.

The principal elements are the village, the technical area, the main weapons range, two air ranges, and minor ranges and services.

Woomera Village.—The residential area at Woomera has been developed to a stage where it can support the daily existence of the range personnel fairly well, although some services are either not yet complete or are of a temporary nature. The village is planned as a normal country town, free from the technical facilities associated with the weapons programme, and with little restriction on the inhabitants.

Five hundred houses have been built, of brick construction and/or prefabricated design. Single quarters for 560 men and 64 women are complete, and similar accommodation for 150 more persons is planned. Messes for officers and N.C.O.s have been provided, as well as accommodation for other ranks.

A community store is in use and includes bakery, milk-handling and cool-storage sections, and petrol pump: a cordial factory supplies cool drinks.

A civic centre of the village is not yet fully developed, such features as a town hall, theatre, hotel and other buildings having been deferred until all operational requirements of the ranges have been provided. However, the more essential items—such as police and fire stations, temporary theatre and post office—are in operation. A concrete swimming pool has been in service since early in 1954, and other recreational facilities, such as tennis and basketball courts, are now available.

The final stage of street construction in the village is under way, and other services (sewerage, drainage, electrical) are virtually completed. Murray River water for the village and the main range is pumped from Port Augusta, where it is drawn from the Morgan-Whyalla pipe line; and a second 2,000,000-gallon water tank is under construction.

A spur railway line from Pimba serves the village (for both goods and passengers) and extends to the technical area.

Technical Area and Airfield.—The main technical and administrative headquarters of the range are located about four miles north of the village. Immediately east of the technical area lies Woomera Airfield, which is the terminal for air services from Salisbury and the main base for operation of aircraft (other than target types) required in connection with the trials programme.

The more important buildings in the technical area are the administrative building, main technical building, project hangar, power house, stores, transport buildings, canteen, bulk-fuel depot, and the centre-of-gravity building. The main technical building provides offices for technical staff, with laboratory and weapon preparation facilities, while the function of the adjacent project hangar is the special fitment of airborne weapons to aircraft.

On the airfield there are two hangars for servicing and maintenance of aircraft, a transmitter building and a small air-transport terminal.

Storage of explosives, fuels and oxidants has been provided in two separate areas near the technical area.

The Main Weapons Range.—The main weapons range is about 25 miles north-west of Woomera and is connected to it by a road of good standard. Power, communication and water lines from Woomera serve the range areas. A camp area with limited living accommodation and range administration and service buildings has been constructed two or three miles from the rangehead.

An extensive programme of construction, commenced in 1952 to provide the special launching and testing installations at the rangehead, has now been largely completed; additions or extensions, however, are foreseen.

Facilities at this range include, generally, the launching aprons, with associated equipment centres and test posts for final checking immediately prior to launching; test shops, behind the aprons, for preparation and checking of weapons after arrival from Salisbury and prior to delivering the launchers; oxidant and fuel filling posts; booster-fitting shops; storage for a limited number of rounds and booster charges; and a large central instrumentation building housing the main control, communication and recording equipment for trials.

Evvetts Field.—Adjacent to the main weapons range, this airfield has been constructed specially for operating target aircraft for use in anti-aircraft-weapon trials. A large hangar, a test shop and a flight control centre are now under construction to cope with the traffic in target aircraft. The runways were recently extended to provide for large types of such machines.

The Air Ranges.—There are two air ranges which have been in use for several years now for bomb ballistic trials of various sorts.

The Ministry of Supply Vickers Valiant which has been flown out from England to spend six months at the Woomera bomb-ballistics range. It will assist in the accumulation of data on the behaviour of bombs dropped from the new V-bombers.

T.A.A.'s Viscounts have performed outstandingly well since their introduction last December. This slipper-tanked model recently covered the 1,790 miles from Perth to Melbourne non-stop in 6 hr 3 min (including 45 min holding) with 450 Imperial gallons of fuel unused.

Commonwealth Airline Development

A YEAR OF ALL-ROUND PROGRESS · INCREASING USE OF BRITISH AIRCRAFT

THE structure of the world-wide network of Commonwealth air services has undergone few major changes since *Flight's* last review of this subject in August 1954. In particular, nothing has been heard recently of B.O.A.C.'s proposed round-the-world service, though the introduction of the Britannia 300 will undoubtedly bring the plan a step nearer to reality. Notable progress has been made, however, both in the development of traffic on Commonwealth routes and in the introduction of new aircraft. Of particular significance is the increasing part played by the British aircraft industry in meeting the requirements of operators within the Commonwealth family. No fewer than ten Commonwealth operators have bought Viscounts.

The largest of the African operators, South African Airways, celebrated its 21st birthday on February 1st this year. At present operating a mixed fleet of Constellations, DC-4s, DC-3s and Lodestars, totalling 25 aircraft in all, the airline has on order three DC-7Bs for use on the Springbok route between Johannesburg and London. The new Douglases are due for delivery early in 1956; their introduction to scheduled service will create an interesting situation in that B.O.A.C., who operate the Springbok route in partnership with S.A.A., are expected to inaugurate Britannia 100 services to Johannesburg at about the same time. No further re-equipment plans have been announced by S.A.A. but their executives will undoubtedly take full advantage of the opportunity to evaluate the Viscount during a six-week programme of hot-weather trials at Johannesburg now imminent.

The first African-operated Viscounts will be the five V.748s of Central African Airways, the first of which is due for delivery early next year. C.A.A., based at Salisbury, are at present operating Vikings, DC-3s and Beavers.

A recent development in this area was the setting up of a subsidiary company by Hunting-Clan Air Transport, Ltd. Known as Hunting-Clan African Airways, the new company has the role of developing air freight traffic throughout East, West and Central Africa and of providing local connections to Hunting-Clan's mainline "Africargo" route to the United Kingdom. The first phase of an ambitious long-term programme was put into effect in June with the introduction of a weekly Hunting-Clan York freighter service between London and Nairobi.

The first local all-freight services in this region were introduced by East African Airways last year. Results were encouraging, and this step contributed much to the 50 per cent increase in cargo traffic announced by E.A.A. at the end of 1954. Increased utilization of the airline's DC-3s also accounted for a notable increase in passenger traffic—from 73,000 passengers carried in 1953 to 93,000 last year. East African Airways are known to be interested in the operation of a coach-type service between Nairobi and London—to be operated, possibly, with Argonauts bought or leased from B.O.A.C. when the Britannia enters the African scene next year.

The main development on the short-haul routes of West African Airways was the inauguration of services, last May, with the first of a fleet of 17-seat Heron 2s. Earlier in the year the company had suffered a setback with the loss of one aircraft and the temporary grounding of the remainder of its fleet. Services were operated by charter aircraft for a period of three months.

The outstanding event in Australian air transport was undoubtedly the introduction of T.A.A.'s Viscount services in December 1954. Within three months an "average fleet" of four aircraft had carried 50,000 passengers and the 100,000 mark was achieved inside six months, by which time a fifth Viscount was in service. Four more Viscounts are due for delivery to T.A.A. within the next year. Operated at an average load factor of 86 per cent, T.A.A. Viscounts have already set up nine new Australian airline route records.

T.A.A., Australia's State airline, operate in keen competition on certain major routes with Australian National Airways, whose fleet now includes two DC-6s and two DC-6Bs which are cruised at a speed approximating to that of the smaller Viscount. Records have changed hands on numerous occasions.

An Australian company, Queensland Airlines, was the first to place an order for the new four-engined Handley Page Herald. Subsequently Australian National Airways' chairman, Capt. I. Holyman, signified his intention to buy 24 Heralds as replacements for their DC-3s. A.N.A. recently became Australia's first airline to form a helicopter division; this will be equipped initially

Six Super Constellations were delivered to Sydney in the first quarter of this year, increasing the strength of the Qantas L.1049 fleet to ten. With a delivery cargo of spare parts in the foreground, one of the six is seen before departure from Lockheed's factory at Burbank.

T.C.A.'s red-and-silver Viscounts have become a familiar part of the Canadian airline scene. This aircraft—the fifth to enter service—was photographed at Lakehead Airport, Lake Superior, which serves Fort William and Port Arthur.

"Flight" photograph

Commonwealth Airline Development . . .

with a Bristol 171 Sycamore, as used by the Royal Australian Navy.

Later this year it is expected that Butler Air Transport will become the first company to use Viscounts exclusively for local services. The company's chairman, Mr. Arthur Butler (who flies as a first officer at least once weekly), has ordered two Viscounts and has an option on four more.

In the long-range sphere, Australia's international airline, Qantas Empire Airways, is now offering far greater capacity than ever before, using a first-line fleet of ten Super Constellations. In co-operation with B.O.A.C., Qantas plan to increase freight capacity on the Kangaroo route between London and Sydney from 80 to 120 tons per month. Next year some of the Super Connies will be specially modified to enable them to carry combined loads of 57 passengers and eight tons of cargo and the airline has also ordered two more L.1049s of improved type which will be used primarily for freighting.

Contrasting with Q.E.A.'s long-haul flights to Europe, Canada, America and South Africa are the New Guinea internal services operated by Qantas with four recently bought D.H. Beavers, one of which is a floatplane version. The recent announcement that Sir Hudson Fysh, founder of Qantas and managing director since 1923, had handed over his executive functions to Mr. C. O. Turner was indicative of the rapid development of the airline, which has a 68,000-mile route network and earns at the rate of £14m per year. Sir Hudson continues in active office as chairman of the board.

In Wellington it was reported last month that New Zealand National Airways had decided to buy three Viscounts for use on routes linking Wellington, Christchurch and Auckland. Delivery of these aircraft, presumably in 1957, would enable the airline to dispose of some of its 23 DC-3s since—given suitable stage-lengths and traffic densities—one Viscount is probably capable of doing the work of four or five DC-3s. The remainder of N.Z.N.A.C.'s fleet is of British origin, comprising four Herons, six Rapides and a veteran Fox Moth.

Replacement of Solents by DC-6s on the main routes of Tasman Empire Airways has greatly improved the airline's financial situation. During the financial year ended March 1955 T.E.A.L. earned a net profit of £60,000 compared with a £168,000 loss in the previous year. Two of these Solents were retained for "Coral Route" services linking Fiji, Western Samoa, Hook Island, Tahiti and Tonga and three were sold to Aquila Airways. Tasman's three DC-6s operate "mixed-class" services between Auckland and Christchurch and Sydney, between Christchurch and Melbourne and also provide connections between Auckland and the Qantas trans-Pacific transit stop at Nandi, Fiji.

As in Australia, inter-city air travel in Canada was revolutionized by the introduction of T.C.A.'s Viscount services in April. Of 25 Viscounts ordered by Trans-Canada Airlines, 13 had been delivered at the time of writing. Within their first three months of service in Canada the turboprop airliners had carried 50,000 passengers and operated at a load factor of 81.5 per cent, compared with 72.6 per cent on other T.C.A. aircraft. Results on the highly competitive Toronto to New York run were particularly spectacular. The number of passengers carried over this route by T.C.A.'s Viscounts represented a 32.6 per cent increase on the figure for the corresponding quarter of 1954, and according to Mr. G. R. McGregor, President of T.C.A. (a former Battle of Britain pilot), flight regularity was "the best in the history of that service."

From personal experience of Viscount travel in North America members of *Flight's* staff can confirm that the aircraft has captivated both passengers and operators. T.C.A.'s engineering staff have been particularly impressed by the unusually low incidence of minor mechanical hold-ups during the introductory period and by the "ruggedness" and reliability of the Rolls-Royce Dart turboprops.

T.C.A.'s Super Constellations, Viscounts, North Stars and DC-3s are now carrying passengers at an annual rate of about 1,500,000, compared with 1,300,000 two years ago. The increase in the freight traffic has been even more striking: freight ton-miles flown in 1954 were 34 per cent more than in the previous year. The three Bristol 170s used on short-haul freight services have lately been supplemented by modified cargo-carrying North Stars for trans-continental service. The latest annual report of T.C.A., incidentally, contains a special tribute to the Canadair-built Merlin-powered North Star ("one of the most reliable and economic air transports ever manufactured"), which is utilized at an average rate per aircraft of over 12 hours daily.

Canadian Pacific Airlines recently became the first Commonwealth airline to use the new Arctic route and the first company to provide direct service between Europe and Canada's west coast. Inaugurated in June, initially on a weekly frequency, the service operates between Vancouver and Schiphol *via* Greenland (westbound) and Manitoba (eastbound). Since it represented an expansion of C.P.A.'s existing route from Vancouver to Sydney, the introduction of this service enabled C.P.A. to claim yet another "first": some of the passengers on the inaugural flight were "the first to have flown in one journey over the International Date Line, the Equator and the Arctic Circle." Among those aboard was C.P.A.'s president, Mr. Grant McConachie, who showed interest in both Comet 4 and Britannia as potential replacements for the DC-6Bs, which serve Latin America, Hong Kong and Tokyo as well as the points named above. The company also operates medium and short stages in Canada using Convairs, DC-3s and a number of smaller aircraft, D.H. Otters (page 294) being among the latest additions.

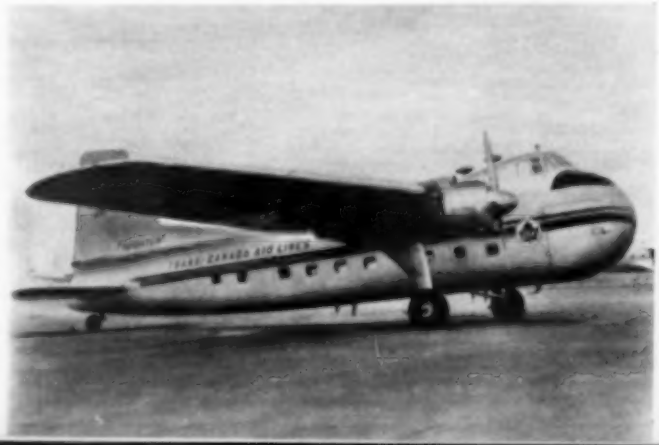
T.C.A. and C.P.A. are, of course, the "big names" in Canadian air transport. In addition, however, there is a wide range of smaller scheduled and non-scheduled air carriers. For many of these companies, the past year's outstanding development has been the growth of the DEWline "Airlift," the purpose and operation of which is described—so far as security permits—on page 317 of this issue.

The Indian Airlines Corporation, which celebrated its second birthday on August 1st, recently placed a long-expected order for five Viscounts, for delivery in 1957. Further orders seem possible, since the Corporation has a total fleet of about 100 aircraft and is thus among the world's largest domestic operators. Most recent additions to the I.A.C. fleet were eight D.H. Herons, which entered service earlier this year.

On overseas routes, India's prestige is upheld by Air-India International, now operating six services weekly on the London-Bombay-Tokyo route with a fleet of five Super Constellations. This airline was one of the first to order the Comet 3, and though this version will not now be produced, Air-India continue to show strong interest in both Comet 4 and Britannia.

In February this year a new Commonwealth company, Pakistan International Airlines, inaugurated weekly Super Constellation services between London and Karachi. Two months later P.I.A. formally took over Pakistan's domestic operator, Orient Airways.

Viscounts are not the only British aircraft in service with T.C.A.; the airline also operates three Bristol 170s on all-freight services. A particularly freight-conscious airline, T.C.A. last year increased its goods uplift by 34 per cent; results for 1955 show further improvement.



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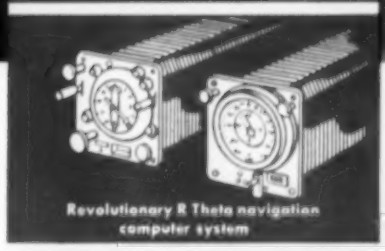

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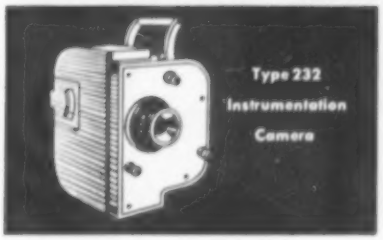

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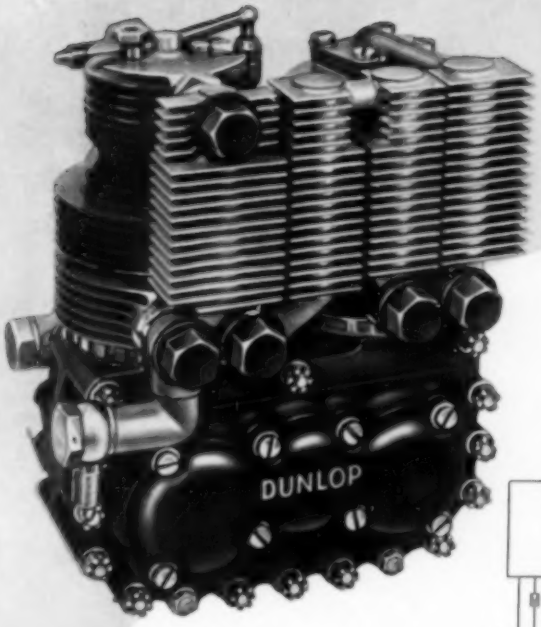

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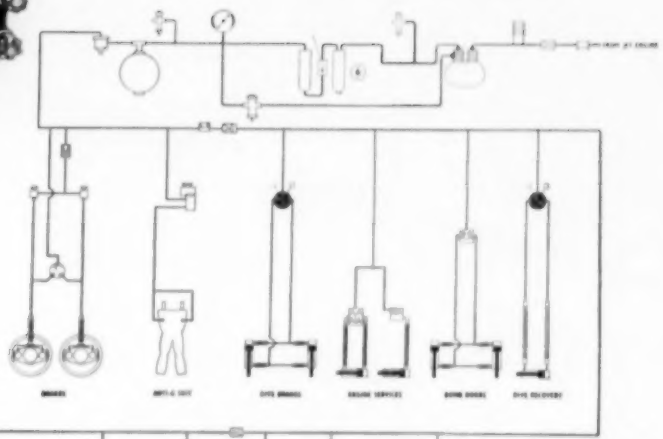

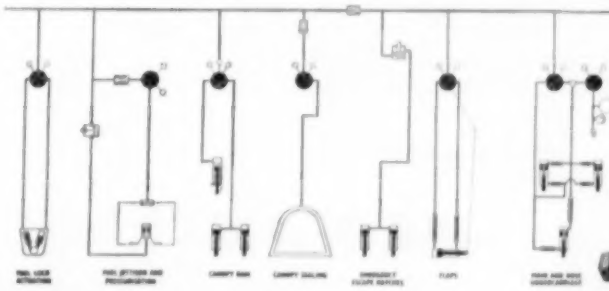

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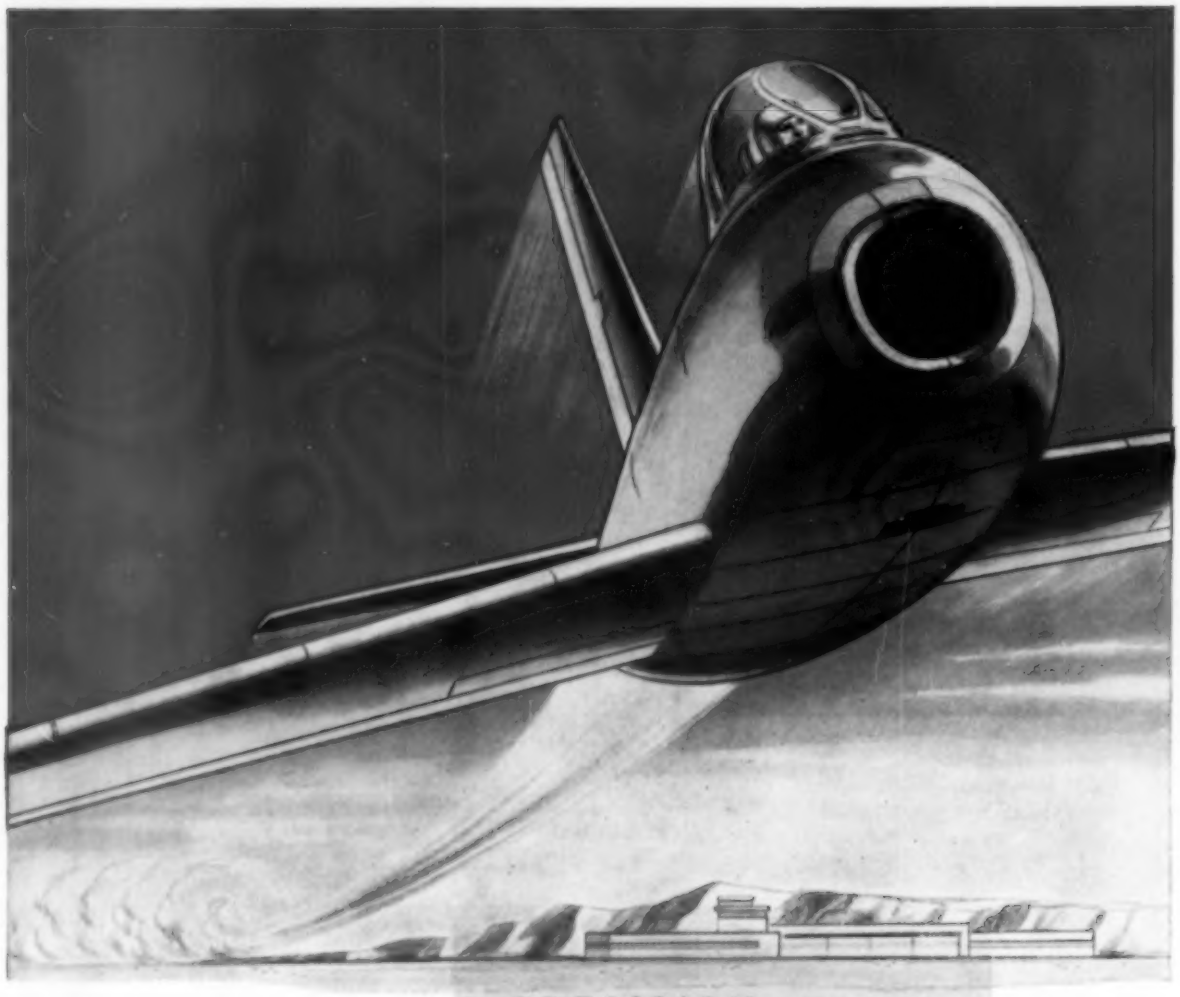

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At Fishermen's Bend, Commonwealth Aircraft Sabres are produced.

THE AUSTRALIAN INDUSTRY

TWO notable aspects of Australian aviation have been apparent for some time; the vitality, economy and practical success of the commercial operators—from the early days—and the Government support given in more recent years to the local construction of military aircraft and engines.

The aircraft factories of Australia at the present time are producing Canberras, Sabres, Vampire Trainers and Winjeel basic trainers, and Avon engines, in addition to the pilotless Jindiviks. Successors to these aircraft are in the offing: the Government is at present considering the recommendations of the joint Services/industry mission on this subject.

In the meantime, a significant step is being taken in Australian aeronautics—the proposed formation of the Australian Aviation Association. Membership, it is planned, will comprise manufacturers, operators and suppliers. This promising move may well bring nearer the time when the construction of an all-Australian civil aircraft will once more be a practical proposition.

On the military side, the production efforts of the main companies over the past year have been well supported by the work of the many ancillary firms. After some earlier delays, Australia reports, progress has been steady.

COMMONWEALTH AIRCRAFT CORPORATION PTY., LTD.

THE first major aircraft manufacturing company to be established in Australia, Commonwealth Aircraft Corporation owes its birth to a conference convened by the Commonwealth Government in 1935 to decide how best the country could arrange to provide for a proportion of its own military aircraft needs. Its formation by a group of large Australian industrial organizations took place in 1936, a year after the conference recommended such a course. Among the names now associated with the concern are I.C.I. of Australia and New Zealand, the Orient Steam Navigation Co., Rolls-Royce, Ltd., and mining and metal companies including the Broken Hill Pty. Co.

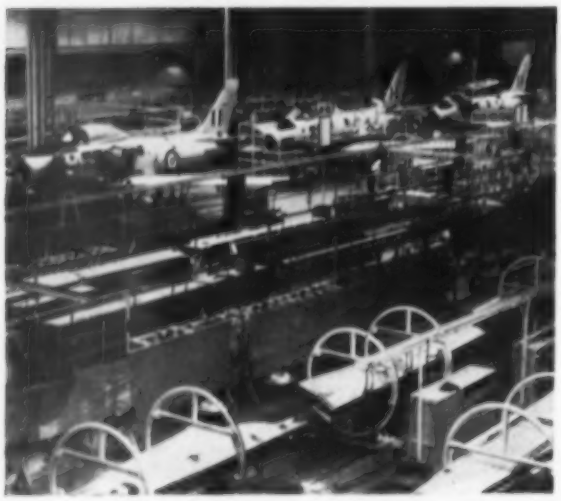
The organization comprises a main airframe-producing plant at Fishermen's Bend, outside Melbourne; the engine factory alongside; and the subsidiary Government-owned engine factory at Lidcombe which C.A.C. operate as a Government annexe. In 1938 C.A.C. established its own aluminium foundry at Fishermen's Bend, and during the war years had turned out more than 2,200,000 lb of aluminium and magnesium castings to meet its own requirements and those of the Australian aircraft industry. In addition, a new foundry was set up at Highett, Victoria, for the production of magnesium castings, and by the end of the war this had taken over production of magnesium castings from Fishermen's Bend. Subsequently, however, another new foundry was brought into use at the main factory, and Highett handled the work for Merlin production at Lidcombe.

The activities of C.A.C. are under the control of the manager, Sir Laurence J. Wackett. The members of the board of directors are Messrs. L. Darling (chairman); Essington Lewis (chairman of the wartime Aircraft Advisory Committee); K. G. Begg; M. L. Baillieu; J. D. Bates and Sir Alexander Stewart. The secretary is Mr. A. G. Brown.

Aircraft Division

The Australian version of the Sabre is the aircraft division's current concern. The production of this aircraft is, of course, by far the most ambitious project so far undertaken by C.A.C., and the

Winjeels being manufactured at the main C.A.C. plant. Deliveries to the R.A.A.F. continue.



Another view of the Sabre line at the Commonwealth Aircraft plant at Fishermen's Bend. Test-flying of completed machines is from Avalon.

The Australian Industry . . .

cost of each aircraft has been estimated as £A250,000. The initial order was for 72 Sabres but this has now been increased to a total of 90, and further orders are expected.

Australian Sabres with Avon RA.7s have reached supersonic speeds, have a climb rate almost twice as great as those variants used in Korea, a ceiling of about 55,000ft, have more formidable firepower (2 × 30 mm guns) and a radius of action exceeding 500 miles with fuel for 15 minutes combat in addition. Provision is made for carriage of air-to-air missiles. Other details are given on page 289.

Production plans for Sabres are based on an output of one aircraft per week, including its engine and spares; by bringing in sub-contractors this could easily be doubled. At present the tapered skins for the wings are imported, as were the production jigs. The first 20 Avons to be installed were Rolls-Royce-built.

All jet aircraft are now transported to the Government's new airfield at Avalon for final assembly and test flying. The old airfield beside the two plants at Fishermen's Bend is retained for piston-engine types only.

At the factory may also be seen the Winjeel production line. The Winjeel is an all-Australian basic trainer designed to much the same specification as the Provost. Two prototypes were built and handed over to the R.A.A.F. for trials, and an order has now been placed for 62 of them. They are being fitted with Wasp Junior engines and delivery to the R.A.A.F. of production machines has commenced.

The decision must soon be taken as to what aircraft is to follow the Sabre. Representatives of the R.A.A.F., Department of Defence Production and aircraft manufacturing companies under the leadership of A.V-M. A. M. Murdoch, visited the U.K., Canada and America in 1954 with a view to selecting suitable types of fighters, bombers and transport aircraft. It is believed that "an air superiority type fighter with supersonic speed" will be chosen.

Engine Division

ENGINE as well as airframe production was started by the Commonwealth Aircraft Corporation immediately on its formation in 1936. The work began with the manufacture, under licence, of the Pratt and Whitney Wasp engine, nearly 700 of which were built for the Wirraway trainer. During the war years Twin Wasp production was added, nearly 900 of these two-row radials being built for installation in Beauforts and Boomerang interceptors. The Wasps were manufactured at the main Fishermen's Bend plant and the Twin Wasps at the Lidcombe annexe factory.

In the post-war years, the Lidcombe factory has mainly been occupied with Rolls-Royce Merlin production and the provision of spares and overhauls for Griffon, Centaurus and Twin Wasp 1830s. The more recent Merlin types have included the 102, for the Lincolns of the R.A.A.F.

Gas-turbine production began with the Rolls-Royce Nene, ordered for the Vampires being built by the Australian de Havilland Company. The Avon was the next type to follow, and early last year R.A.3s were being delivered for Australian-built Canberras, but tooling was already in hand for a change-over to R.A.7s; when fitted to the Sabre this latter type is known in Australia as the Mk 20 and, in the Canberra, Mk 109. The Mk 20 has a constant-taper Solar jet-pipe and a 200 h.p. gearbox take-off with spiral bevel drives. Only spares are now being made for the Nene.

All the main components used in Avon production are manufactured by C.A.C. The Lidcombe factory puts out very little work to sub-contract and, in fact, makes not only major components but its own A.G.S. parts. It also provides its own tooling

requirements and has additional capacity which enables it to do tooling work for Avon production both at Fishermen's Bend and at General Motors Holdens, Ltd. C.A.C. have four test-beds at Fishermen's Bend, two for piston engines and two for gas turbines.

The most recent product of the Fishermen's Bend factory is an all-Australian 450 h.p. seven-cylinder radial known as the Cicada, designed and developed in the works. The first of these units began its type-tests in March 1953. It was originally intended that the Cicada should power the Winjeel trainer, but it has since been decided to retain it as a reserve design for emergency production.

DE HAVILLAND AIRCRAFT PTY., LTD.

PERSONNEL employed at de Havilland's Bankstown factory and the propeller division at Alexandria have increased by 290 since our report of the company's activities appeared in last year's Commonwealth issue. This has been due mainly to an increase in servicing work, the activities of the company's service department having grown considerably since the beginning of 1955. Overseas customers are increasing and now include operators in Malaya, Portuguese Timor, Fiji and New Zealand.

The scope of repair work carried out on Air Force Vampires and Vampire Trainers has widened greatly, and these aircraft are returned regularly for the installation of all but the most urgent modifications. This work is carried out in a modification centre which exists within the workshop organization; at the moment its major task is the retrospective fitting of ejection seats to all Australian Vampire fighters. A major job soon to be commenced will be the installation of radio-compasses on all Vampire fighters and trainers.

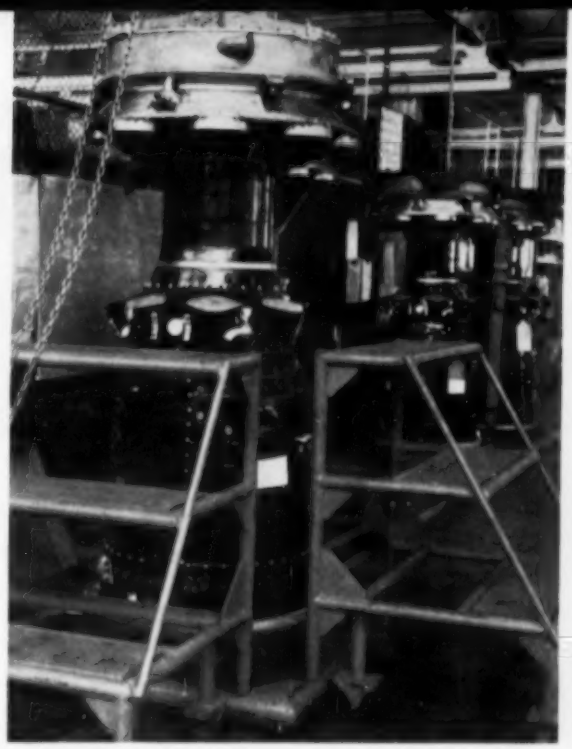
Vampire Trainer production is continuing but, at present, work in hand is almost exhausted. It is understood that the Vampire Trainer will be adopted by the R.A.A.F. as its advanced trainer and, if this is done, there will be a demand for many more Trainers which would imply continued production of this aircraft for another three or four years.

In addition to the activities of the de Havilland enterprise at the Weapons Research establishments at Salisbury and Woomera, the Australian company has now created the nucleus of a guided weapons team.

The Beaver has at last entered Australia—although dollar restrictions have eliminated many prospective customers. In the last twelve months the company have brought five into Australia; these have been erected at Bankstown and fitted out to meet local requirements. Four have been sold to Qantas for operations in New Guinea highlands and the fifth (with floats, skis and wheels) has been delivered to the Australian Antarctic Division. By December this year the antarctic Beaver will be flying from Mawson, the Australian base on the antarctic continent.

Future plans concern the further expansion of the service department, which will take place before the end of 1955. This will provide facilities for the servicing of the Mark 53 Sea Venoms which will arrive in Australia next year. These aircraft will be provided with service similar to that given to the Air Force Vampire types, and an appropriate programme of work for 1956 is now being drawn up.

Production of Vampire Trainers at the de Havilland factory at Bankstown is tailing off, although further orders may be placed.



Vertical assembly of Rolls-Royce Avons is employed at the C.A.C. Engine Division plant.

Previously general manager of Trans-Australia Airlines, L. J. Brain joined the company's board in March, 1955, and was appointed managing director. The board now consists of A. Murray-Jones (chairman), L. J. Brain, R. J. Vicars, D. H. McLachlan and J. J. Byrne.

GOVERNMENT AIRCRAFT FACTORY

FUTURE production programmes at the Government Aircraft Factory at Fishermen's Bend, in common with those at other Australian aircraft plants, hinge at present on the results of the joint R.A.A.F./Industry Mission which has toured production facilities in the U.K., Canada and the U.S.A. within the last year. In the meantime, production of Canberras for the R.A.A.F., and Jindivik pilotless targets and research aircraft for the Australian Government and the U.K. Ministry of Supply, continues.

The Australian Government, through the Department of Defence Production, is more directly concerned with the work of the Government Aircraft Factories than are any of the other Dominion Governments with their aircraft manufacturing organizations. During the war the other large Australian companies came into the government fold, and it should be remembered that the annexes operated by C.A.C. at Lidcombe and de Havilland at Alexandria (which are described under their company headings) are, in fact, government factories.

Manufacture in Australia of aircraft required by the Department of Air for equipping the R.A.A.F., and by the Department of the Navy for Naval operations, is arranged by the Division of Aircraft Production of the Department of Defence Production. The division is responsible also for the supply of maintenance spare parts to the extent to which they can be obtained against orders placed in Australia; and for the repair and overhaul in civilian establishments of aircraft, aero engines and auxiliary equipment operated by the Australian Services.

During the war years, the Government Aircraft Factory delivered 700 Beauforts and 329 Beaufighters and was well advanced with the establishment of facilities for the production of Avro Lincoln bombers when the war ended. Beaufort/Beaufighter production was maintained at the average "pegged" rate of 30 per month over a considerable period.

These wartime facilities employed approximately 10,000 men and women at the peak of activity. With the cessation of war, the scale of activities was rapidly reduced. Beaufighter production continued to the completion of aircraft then at an advanced stage of production and reached a total of 364.

The factory activities were concentrated into the major workshops at Fishermen's Bend, Victoria, with sheet metal assemblies at a subsidiary plant at the Essendon Airport, Victoria. Token production only was maintained at the State Railway workshops.

Lincoln production was restricted to not more than one aircraft per month to maintain nucleus capacity and essential manufacturing skills and techniques for preparedness reasons.

The Lincoln production programme was completed during 1953 at 73 aircraft delivered, including a number of aircraft

The Australian Industry . . .

incorporating a major modification—extension of the front fuselage by 6ft—to convert the aircraft into a more effective long-range anti-submarine type.

Early in 1950 the Government Aircraft Factory was entrusted with the production of English Electric Canberras. The first Australian Canberra made its initial flight in May 1953, and production is at present proceeding smoothly, the machines equipping the squadrons of No. 82 R.A.A.F. Bomber Wing at Amberley, Queensland. The current programme is for 48 aircraft, although a possible further order has been reported.

Jindivik target and research aircraft—Mks 1 and 2—with Armstrong Siddeley Viper turbojets, are also being manufactured. A substantial order for Jindiviks has been placed by the U.K. Ministry of Supply, in addition to those for the Australian Government.

The central establishment of the Government Aircraft Factory is the Main Assembly Plant at Fishermen's Bend, Melbourne. Supplementary establishments comprise a workshop at Essendon Airport, Melbourne; the flight-test field, with final assembly and flight-shed facilities, at Avalon; and major sub-contractors.

At Fishermen's Bend are the administrative, design and planning offices, machine shop, tool room and experimental workshops, as well as the main assembly plant. Here is carried out the manufacture and assembly of Canberras and Jindiviks. Included among the departments is one for plastic forming and another in which both Redux and Araldite techniques are employed. Assembly occupies 177,000 sq ft of floor area; the machine shop 28,000 sq ft; and another 23,000 sq ft are devoted to experimental work.

At the Essendon factory are manufactured some details and sub-assemblies. Major sub-contractors and their products are as follows: Chrysler Australia, Ltd., Finsbury, S. Australia (manufacture of pressed parts and sub-assemblies); South Australian Railways, Islington, S. Australia (manufacture of wing spars); New South Wales Railways, Chullora, N.S.W. (manufacture of sundry details and sub-assemblies).

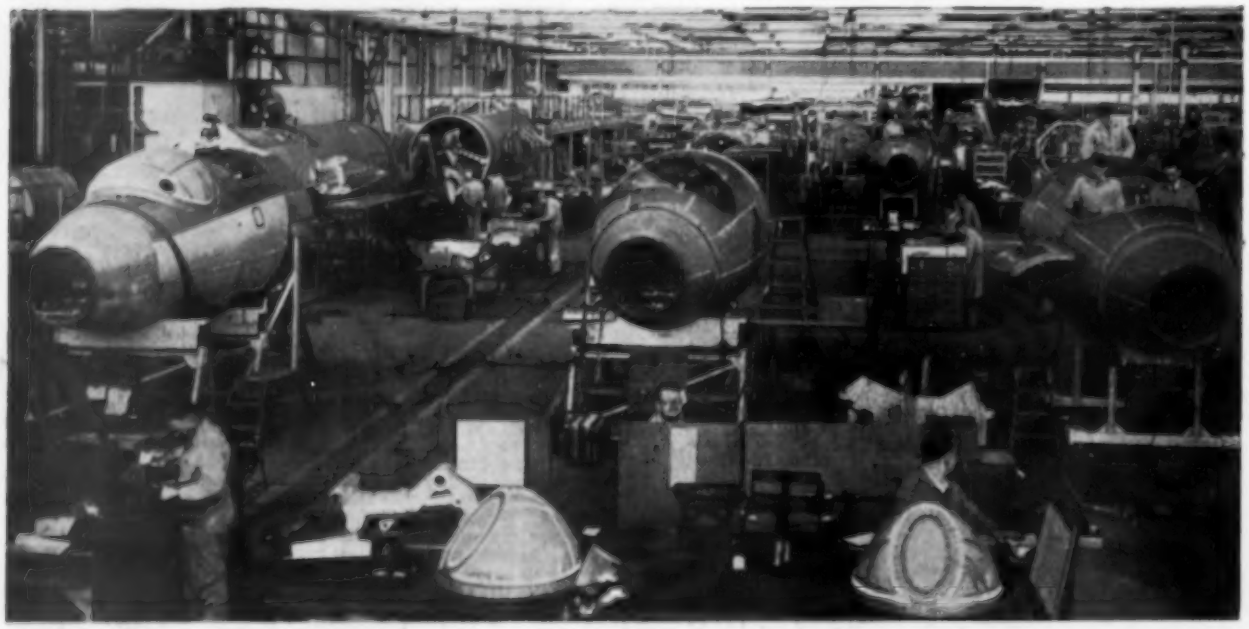
The Government Factories have a considerable repair, modification and spares commitment for the R.A.A.F., and the section devoted to this work occupies 37,000 sq ft. In addition there are instrument and radio rooms, separate maintenance workshops and a central stores which itself covers 84,000 sq ft.

Today, the Department of Defence Production is directed by the Minister, Sir Eric Harrison. The officers of the department controlling the Division of Aircraft Production are the secretary, who is the permanent head, H. P. Breen; the controller-general of Munitions Supply, R. H. Doyle; and the assistant secretary (Aircraft Production), J. Hanford Stevens. At the Government Aircraft Factories the general manager is Mr. B. Woodfull, and the manager at Fishermen's Bend is N. W. Hodgson. The Maintenance Branch is headed by M. A. W. Forestier, while at the new establishment at Avalon the area manager is J. C. Miles.

Jindivik production for the Government Aircraft Factory includes sub-contract work: here front fuselages are being built by Chrysler at Finsbury, South Australia.

In addition to the manufacture, shown here, of Vampire Trainers, repair, overhaul and modification of this type is also carried out by de Havilland Aircraft.

Assembly and fitting-out of Canberra main components at the Government Aircraft Factory's main assembly plant at Fishermen's Bend.



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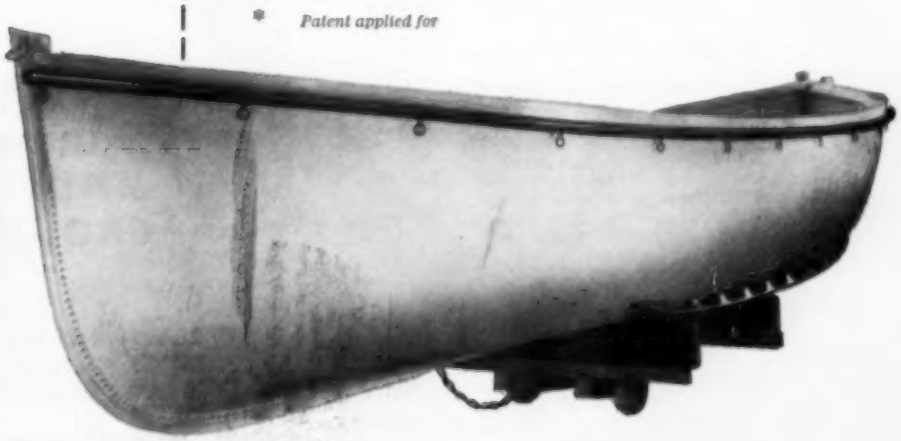

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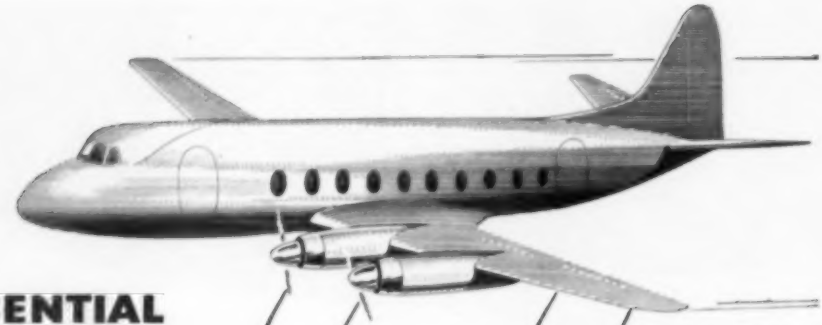

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Bristol's airframe-overhaul hangar at Bankstown Airport; types handled include Sycamore helicopters.

THE AUSTRALIAN INDUSTRY . . . Ancillary Companies

Amalgamated Wireless (Australasia), Ltd.

FOUNDED in 1913, this company manufactures all types of radio and electronics equipment, and is claimed to be the largest such manufacturer in the southern hemisphere. A.W.A., in addition to manufacturing equipment under Marconi patents, has itself designed and produced a wide range of radio components and installations.

One important aspect of the company's activities is that of servicing, and depots are maintained at all commercial airports for the installation and servicing of radio equipment and navigational aids. Airlines served include B.O.A.C., K.L.M., Pan American and C.P.A., in addition to Qantas and all Australian domestic carriers.

Among major contracts is that for the manufacture and supply of 98 distance-measuring equipment beacons at airports throughout Australia and New Guinea. This work, together with the manufacture and installation of associated airborne equipment, is almost completed. It may be remembered that the VAN-3 series of 200 Mc/s D.M.E. is a double-pulse system available for 100, 200 and 300 nautical miles range; other radio products include the lightweight HAC-1 high frequency transceiver, the HAC-2 120-channel receiver and the "Air-mite" V.H.F. transceiver for light aircraft use. The managing director of A.W.A. is L. A. Hooke and J. M. Johnson is aviation wireless manager.

Australian Forge and Engineering Pty., Ltd.

A SUBSIDIARY of High Duty Alloys, Ltd., of Slough, Australian Forge and Engineering are currently involved in producing airframe forgings for the Canberra, Sabre, and for Avon blades. At Lidcombe, drop-forgings in steel, copper alloys and light alloys are produced together with the airframe and engine forgings; while the plant at Brooklea, Victoria (operated by the National Forge Pty., Ltd.) produces gas-turbine blading in light alloys, aluminium bronze and Nimonic alloys.

Materials and methods employed in the production of light-alloy forgings are those evolved in association with the parent company.

The Bristol Aeroplane Company (Australia) Pty., Ltd.

MAINLY a sales organization and controlling company for Bristol activities in Australia, this company is thereby concerned with aircraft, aero engines, and guided missiles. The actual overhaul work performed by Bristols in Australia is the responsibility of **Bristol Aviation Services Pty., Ltd.**, of Bankstown.

Bristol Aviation Services' facilities comprise an airframe and electrical overhaul shop at Bankstown Airport, and an engine overhaul section at Short Street, Bankstown, some four miles distant. Both plants are now being extended, each by some 11,000 sq ft.

An expansion in overhaul activity to include work for Australian National Airways and Trans-Australia Airlines has taken place during the past year. Aircraft types at present overhauled in the airframe shop include Bristol Freighters, Beaufighters and Sycamore helicopters, and DC-3s; while the engine section handles Hercules, Leonides, and P. and W. engines, Rotol gearboxes and all types of engine accessories.

Director and general manager of both B.A.C. (Australia) and Bristol Aviation Services is C. H. Tucker.

Dowty Equipment (Australia) Pty., Ltd.

THE overhaul of landing gear and hydraulic equipment and the manufacture and distribution of spare parts continues to be the function of Dowty Australia, under the technical control of the British parent company at Cheltenham. This work relates to aircraft equipment for the R.A.A.F. and R.A.N., and is carried out at the company's plant of 5,500 sq ft in Bankstown, N.S.W.

Extensions now in hand will provide comprehensive overhaul and testing facilities for fuel systems in readiness for the arrival of R.A.N. Gannets and Sea Venoms in Australia next year. Factory manager at Bankstown is F. C. Woodley, under P. F. Handcock, director.

Fairey Aviation Company of Australasia Pty., Ltd.

DURING the past year, Fairey Australasia have entered the civil-aircraft overhaul field (in addition to continued work for the R.A.N.) and have considerably expanded their facilities and work in connection with guided missiles. The company is organized in two independent divisions, at Bankstown Airport, N.S.W. (aircraft), and Salisbury, South Australia (special projects), with the head office at Bankstown.

Floor area of the aircraft division remains approximately 106,000 sq ft, and the division is continuing its repair, reconditioning and modification work of Firefly and Sea Fury aircraft for the Australian Navy. Two further Mk 5 Fireflies are being converted to the trainer version, following delivery to the R.A.N. of the first in May of this year. Full reconditioning of further Fireflies is continuing, indicating that the machine is to remain in service, although the Gannet will supersede it operationally as first-line equipment when the new H.M.A.S. *Melbourne* arrives next May.

Planning is well advanced for the repair and maintenance of the Gannet, floor-space having been allocated and repair jigs laid out. In the meantime, Fairey continues the design and fabrication of

Facilities of the Bristol company include this engine overhaul shop at Short Street, Bankstown.

Sea Fury repair reconditioning line at Fairey Australasia's Bankstown plant.

The Australian Industry . . .

experimental installations to meet the requirements of the R.A.N.

Since June, 1954, as R.A.N. commitments began to taper off, the company entered the civil-aircraft overhaul field and have undertaken the complete overhaul of DC-3s for Australian National Airways. By June of this year, 12 aircraft had been completed for A.N.A., one for Mandated Airlines of New Guinea, and a Lockheed 12A for the Zinc Corporation of Broken Hill. In addition, sub-contract work is carried out for the aircraft industry.

A well-equipped radar and radio test section has been established in recent months, and the company has assumed responsibility for the clearance of all such installations in R.A.N. aircraft. A Bellman hangar is being refurbished and equipped by the Department of Works with improved facilities for spraying and paint-stripping operations.

At Salisbury, the special projects division has acquired an additional 10,000 sq ft of workshop space on which equipment has been set up to manufacture specialized plastics components, and electromechanical and mechanical instruments connected with guided missiles. The division, with a total floor area of 50,000 sq ft, is extremely active at present, manufacturing test vehicles, instruments and associated missile components.

The managing director of the Fairey Aviation Company of Australasia is Raymond E. Purves. At Bankstown, A. Cdre. C. B. Wincott is general manager, L. C. Williams engineering manager and F. O. Walker production manager of the aircraft division, while the special projects division is headed by Col. R. T. Elvish.

Goodyear Tyre and Rubber Co. (Australia), Ltd.

THE Goodyear plant at Granville covers some 17½ acres, where aircraft work is combined with commercial tyre production. The company is a relatively old-established one, having been founded in 1927, and during the war it pioneered the production in Australia of self-sealing fuel tanks, aircraft wheels and brakes. For the aviation industry, the company's products comprise the well-known series of Goodyear aircraft tyres and tubes.

Managing director of the Goodyear company is H. C. Steiner.

Imperial Chemical Industries of Australia and New Zealand, Ltd.

THIS company, commonly known as ICIANZ, manufactures chemical and allied products in factories in Melbourne, Sydney and Adelaide. Among products of interest to the aircraft industry are polyvinyl chloride polymer; urea formaldehyde moulding-powders, syrups and resins; paint products; trichlorethylene, alkalis, and degreasing equipment; leathercloth; and nitric acid.

Polyvinyl chloride production at the Sydney factory is now sufficiently large to meet all Australian demands, including those for compounds, paste polymers and fabricated sheet. Leathercloth output includes both "Vynex" (p.v.c.-coated) and "Fabrex" (nitrocellulose-coated). Paint products are handled by a subsidiary, BALM Paints Pty., Ltd., who manufacture a range equivalent to that of the I.C.I. Paints Division.

In addition to these Australian-manufactured items, ICIANZ are a selling organization for a wide range of I.C.I. products. Those available to the aircraft industry include Perspex acrylic sheet to D.T.D. specifications; heat-treatment salts; ethylene glycol; engine-starter cartridges; and isopropyl alcohol.

Lucas-Rotax (Australia) Pty., Ltd.

IN 1951, the merger of Joseph Lucas (Australia), Ltd., and Rotax, Ltd., into Lucas-Rotax (Australia), took place. Previously the Lucas company at Melbourne, which had undertaken the servicing and overhaul of Rotax electrical equipment in 1937, had continued with this work until 1946 when the Australian Rotax company was formed.

Development since 1951 has led to the establishment of factories at Sydney and at Cheltenham as well as Melbourne, covering a total floor area of some 10,000 sq ft. The firm is approved by the Australian Department of Civil Aviation for the manufacture, repair, overhaul and modification of Lucas fuel systems and control equipment for gas turbines and Rotax electrical accessories and equipment, and, in addition, for the repair, overhaul and modification of Negretti and Zambra flowmeters, electrical accessories and equipment, fuel, vacuum and hydraulic pumps and associated control gear, ignition apparatus and armature windings. The distributing of Lucas, Rotax, Eclipse, Saunders, and Negretti and Zambra products is also performed.

At present, all fuel equipment (including turbine starters) is tested at the Sydney factory; the Cheltenham plant services all electrical and gas-turbine fuel equipment; and at Melbourne there are certain specialized test facilities. In the near future it is hoped to concentrate all the work at the Sydney plant, which will then become the company's head office. Vice-chairman and general manager is E. G. Potter.

National Instrument Company Pty., Ltd.

THIS company, a subsidiary of Australian National Airways, is at present applying its experience in aeronautical instruments towards the development of measuring, controlling and electronic instruments for defence projects in the fields of pilotless aircraft and guided missiles. Its overhaul and repair background in connection with instruments for civil airlines has provided the foundation on which to embark on a development and manufacturing programme of considerable magnitude.

The N.I.C.'s experimental section is producing prototype instruments, which have been flight-tested with success. The development and manufacture of telemetering, electronic, pressure and temperature indicating and recording instruments are being expanded rapidly. The first building (of 13,000 sq ft) of the plant extensions has just been occupied and is devoted to machining, thermometry, assembly, welding and spray painting. It is situated adjacent to the existing workshops at Essendon.

The company acts as sales and service agents for a variety of

aircraft communication equipment, including the products of Sperry, Plessey, and R. B. Pullin. Present staff numbers 345; workshops are also maintained at Sydney, Brisbane, Adelaide and Perth. The general manager of N.I.C. is W. H. Bauld; W. V. Horsnell is aeronautical and marine superintendent.

Normalair (Australia) Pty., Ltd.

NORMALAIR have now moved from their Heidelberg factory to the new plant erected for them by the National Instrument Corporation at Essendon. This unit has much better facilities than the previous premises, and has been equipped with all necessary test rigs, air blowers, exhausters, etc., to deal with the servicing, maintenance and overhaul and assembly of all Normalair cabin pressurization products.

Also handled are similar products, including refrigeration turbines and air compressors, of AiResearch design, an overhaul agreement having been signed between the Normalair and AiResearch companies; and greater space is available at the new plant for undertaking repair and overhaul of fuel pumps and other units made by the Self-Priming Pump and Engineering Co. of Slough, with whom, also, Normalair have an overhaul agreement. Flight Refuelling fuel-system valves are also serviced.

The company has taken on quite a number of new staff during the past year and is continuing to expand. The factory is managed by Mr. Ken Drew—who was previously with T.A.A.—and one of the major activities this year has been the start of overhaul and servicing of equipment on T.A.A. Viscounts.

Rolls-Royce of Australia Pty., Ltd.

PRIOR to the registration in November 1952 of this wholly owned Rolls-Royce subsidiary, R-R activities in Australia comprised liaison, sales and service. The new company, believed to be the first British self-contained gas turbine overhaul establishment in the southern hemisphere, came into full operation almost exactly a year ago, and has experienced a satisfying period since of building-up to an adequate and successful load capacity.

From the new factory at Melbourne, operators of Rolls-Royce gas turbines are provided with complete overhaul and spares backing for the Australian continent. This service has, of course, proved significant in connection with the operation of Vickers Viscounts by Trans-Australia Airlines. The coming year, the Rolls-Royce company states, will see a greatly increasing effort in the support of the Dart servicing throughout the Far East.

Another major project which will occupy the company during the next twelve months is an extensive contract covering the overhaul of Rolls-Royce Avon turbojets for the Royal Australian Air Force.

The company's factory on the boundary of Mascot Airfield comprises some 40,000 sq ft of shop and office space and a dual test-bed building of some 10,000 sq ft. In addition to the overhaul work on Darts and Avons the plant handles the supply of material and engine spares for these engines throughout the Far East.

The Rolls-Royce Australasian technical office in Melbourne continues to handle liaison, sales and service in connection with the company's products. Liaison includes contacts with the Commonwealth government in connection with licences for the Avon, Nene, Merlin and Griffon engines; with the Royal Australian Air Force on their Rolls-Royce products; and after-sales service to other users of Rolls-Royce military equipment in the Southwest Pacific. Sales and service are also connected with the whole of the Southwest Pacific, and with the Far East for aircraft and oil engines and cars.

The new Melbourne premises of S. Smith and Sons (Australia) were inspected on the occasion of their opening by T.A.A. and R.A.N. representatives.

General manager and director of Rolls-Royce of Australia is A. H. Harvey Bailey.

Shell Company of Australia, Ltd.

IT was in 1901 that the Shell Transport and Trading Company began operations in Australia, prior to the formation in 1905 of the British Imperial Oil Company (a Shell subsidiary) to conduct the group's business in this continent. The name was changed to the Shell Company of Australia in 1927, and Shell Refining (Australia) Pty., Ltd., was formed in 1952.

The group's aviation service has provided fuel and oil for aircraft from the early days, and pioneered the refuelling points along the England/Australia route in association with Imperial Airways and Qantas. The company's service to aviation in Australia dates back to Ross and Keith Smith's flight in 1919, when bulk distribution was adapted to the needs of aircraft refuelling. Many refuelling points were remotely located and, before regular airline networks were established, the company operated its own aircraft for the inspection of these outposts.

The service has developed from the stage when aircraft were refuelled from two-gallon red cans, to the modern refuelling lorry having a capacity of 4,500 gallons and a delivery rate of some 300 gallons per minute.

Present facilities comprise a 1,800,000-tons-per-year refinery at Geelong, near Melbourne; a 420,000-tons-per-year refinery at Clyde, near Sydney; and 119 aircraft service points in continental Australia. In addition, a comprehensive network of fuelling points is maintained throughout the Pacific Islands, and on Cocos Island a complete service is maintained for the Sydney-Johannesburg Springbok route, the world's longest scheduled over-water flight. The total installation tankage for aviation fuels is 30,500 tons and over 69,000 aircraft were fuelled during 1954.

During last year Shell began the construction of a number of large hydrant refuelling systems. The company was also contract suppliers of aviation gasoline to the R.A.A.F., T.A.A., and Qantas. Chairman of Shell Refining (Australia) is J. R. C. Taylor, who is also chairman of the local board of the Shell company of Australia.

S. Smith and Sons (Australia) Pty., Ltd.

AT the beginning of this year new instrument development and test laboratories of S. Smith and Sons were opened in Melbourne, and in July the aviation division of the company took over a section of the new Smith factory at Granville, N.S.W., to handle the expansion in aviation activities. The company, a subsidiary of the well-known Smith's Aircraft Instruments organization of London, is mainly concerned with the servicing, overhaul and repair of the full range of the parent company's products in both N.S.W. and Victoria.

Similar servicing facilities are provided for the products of the American Kollsman and Liquidometer Corporations, and the company are suppliers of the range of test apparatus manufactured by Bryans Aeroquipment. Special test equipment for military requirements is also manufactured by S. Smith and Sons.

Current contracts cover the entire instrumentation for Australian Canberra and Vampire programmes, and for the C.A.C. Winjeel; and, together with Liquidometer and Kollsman, 70 per cent of the instrumentation of the Avon-Sabre.

Factories are maintained at Redfern and Ashfield, N.S.W., and aircraft instrument laboratories at Bankstown aerodrome, N.S.W., in addition to the new facilities mentioned above at Melbourne and Granville. Chairman of S. Smith and Sons (Australia) is Lionel Hooke, who is also managing director of Amalgamated Wireless (Australasia). The aviation division manager is Frank J. Shaw.

Vacuum Oil Company Pty., Ltd.

THIS company, having supplied fuel and oil to Australian aviation since the infancy of flying in the Dominion, now markets and distributes aviation gasolines, aero engine oils and special aviation oils and greases in Australia, New Guinea, Fiji, New Caledonia and Norfolk Island. Grades of aviation petrol range from 115/154-octane to 73-octane, and aviation turbo fuel and turbine lubricating oil are also marketed. Refining is the responsibility of an affiliated company, Standard-Vacuum Refining Co., Ltd., of Altona, Victoria, who expect to have an alkylation plant to produce aviation fuel in operation by the middle of 1956.

Airport facilities range from comprehensive underground hydrant systems, capable of refuelling aircraft at 400 gal-min, at major airports to hand-operated dispensing equipment at emergency landing grounds. At Sydney, Melbourne and Nadi international airports there is round-the-clock service, and 18-hours-a-day service at the airports of all capital cities.

The company is also serving the Woomera rocket range, while another recent enterprise is the supply of products and special services to the Australasian Petroleum Co. Pty., Ltd., who are searching for oil in Papua, New Guinea, using Bell helicopters and other aircraft.

The chairman and managing director of the company is J. D. Jacobs.

INDIA

HT-2 trainers on the assembly line at Bangalore.

HINDUSTAN AIRCRAFT, LTD.

INDIA'S only aircraft manufacturing organization, Hindustan Aircraft, serves not only the country's domestic needs, but also those of many of the airline operators and Air Forces in Asian countries and the Middle East. H.A.L. is the largest aircraft repair, overhaul and manufacturing organization in the East, and possesses its own airport and seaplane landing base.

The company's works are spread over 1,100 acres of land, and are equipped with engine and accessories shops, a first-class laboratory, foundry, machine shop and tool room. The design, engineering and research departments are manned by fully qualified engineers, the total number of personnel employed being about 10,000. The factory has earned the recognition of the Director-General of Civil Aviation in India, and has been approved by the American C.A.A. for the repair and overhaul of DC-3s, C-47s and Pratt and Whitney aero-engines.

On the manufacturing side the HT-2 trainer, designed and developed by the company, is now in full production. The aircraft has been tested by Indian and foreign pilots, and has been certified as a suitable trainer for basic training for the Indian Air Force, to whom deliveries are being made in batches. The Director-General of Civil Aviation also has placed an initial order. The Government of India having permitted export, the company is presently making plans to demonstrate the aircraft in nearby countries. H.A.L.-built Vampire fighters are being supplied to the Indian Air Force according to programme.

Hindustan Aircraft is an overseas member of the S.B.A.C. In addition to the C.A.A. approval for DC-3 work, the company is also an authorized DC-3 service centre of the Douglas company. H.A.L. is also the sole repair and service agent in India of the de Havilland companies. Aircraft types for which repair and overhaul facilities exist include (in addition to Dakotas) Doves, Harvards, Liberators and Tempests.

The company's branch factory at Calcutta is continuing to concentrate on repair and overhaul of DC-3s belonging to the Indian Airline Corporation and non-scheduled operators. Future plans at the main Bangalore factory are centred on a basic jet trainer, which is being designed at present. A medium transport aircraft is also under development.

The company is under the direction of the Ministry of Defence of the Government of India. Local management heads include J. M. Shrinagesh, managing director and general manager; R. Natarajan, deputy general manager; and Dr. V. M. Ghatage, chief designer.

NEW ZEALAND

WITH some 300 cities and towns served by air, and a total of about 80 aerodromes, New Zealand has an extremely healthy operating side to its aviation life. No aircraft are designed or manufactured there, however, due to the high cost inevitably involved in small-batch production at the present time.

In the sphere of agricultural flying, New Zealand is unique in its development, since 1949, of aerial top-dressing—the spreading of fertilizer and grass seed by air on inaccessible high grazing country. As in other spheres, the ubiquitous Tiger Moth has been adopted and adapted for this specialized application, but the country's urgent interest in a purpose-built machine has accelerated the development elsewhere of new designs.

The Fletcher FU-24, manufactured in the U.S.A. and assembled in New Zealand, is the first type to be specially designed for top-dressing. At present it is still a relative newcomer, having only recently received a type certification from the New Zealand Director of Civil Aviation.

It is on this background, with its emphasis on agricultural flying, that New Zealand's framework of ancillary companies has been built up. At aerodromes throughout the country, small groups of aeronautical engineers have become skilled, not only in routine aircraft maintenance, overhaul and repair work, but also in the design and manufacture of hoppers and other specialized equipment, and the modification of aircraft to take these installations. It is these firms, together with the agents for the major British aircraft constructors, which form most of the entries in the New Zealand section of the Commonwealth directory on p. 331. The two firms here noted are concerned with aircraft assembly, as well as with major repairs and overhaul.

The de Havilland Aircraft Company of New Zealand, Ltd.

SINCE the war the New Zealand branch of the de Havilland Aircraft Company has overhauled, serviced and maintained aircraft and engines for the R.N.Z.A.F., N.Z. National Airways Corporation, flying clubs and private owners. Devons for the New Zealand Air Force have been assembled, in addition to a number of Fox Moths and Chipmunks for flying-club operation.

The company's main plant, occupying just under 30,000 sq ft, is at Rongotai aerodrome, Wellington, where during the war the manufacture of 345 Tiger Moths had taken place. At Palmerston North, an overhaul shop for R.N.Z.A.F. Goblin turbojets is in operation.

English directors of the company are Sir Geoffrey de Havilland, F. E. N. St. Barbe, and W. E. Nixon; while J. A. Kerr (general manager) and D. W. Gendall (secretary) are the New Zealand directors.

James Aviation, Ltd.

PLANS for the importation of Fletcher FU-24 agricultural aircraft into New Zealand have been made by the Cable-Price Corporation, and assembly of these machines is to take place at the Rukuhia workshops of James Aviation, Ltd. The design of the FU-24 is stated to be based on the 1951 New Zealand specification for a topdressing aircraft, and the recent type certification now clears the way for a full assembly programme.

In addition to this work, the firm carries out agricultural and charter flying, and possesses an extensive aircraft repair organization. The managing director of the company is Mr. O. G. James; bases are at Rukuhia and Rotorua.

Arrested Development

At first sight two pairs of horns over and above the standard equipment and a bulk in proportion may not look like a case of arrested development, but even so the Uintatherium was deficient where it really mattered. His mental capacity lagged several million years behind his cubical contents with the result that other and less ponderous creatures in his class outsmarted and ultimately outlived him.

In development projects, a balanced approach is as vital today as it was 75 million years ago. It is impossible to design an aircraft to a given specification without considering what fuels and lubricants will be available for it and how they will perform under the operational conditions. To all such questions Esso will furnish a prompt answer based on the company's unique specialised experience in the aeronautical field.

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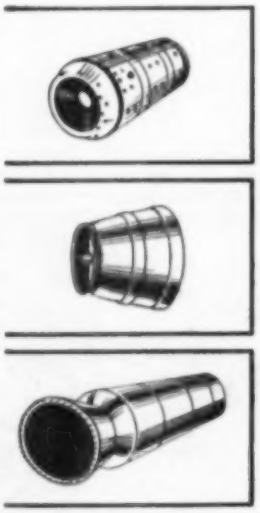

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COMMONWEALTH DIRECTORY

THIS year's directory of Commonwealth aircraft, ancillary and associated companies has been expanded to include a New Zealand section, and also index references to organizations described more fully earlier in this issue. In addition, the Canadian section has been greatly enlarged

The development of the Canadian aircraft industry is an excellent example of the deliberate building-up of a complete supporting-firm framework in order to enable the main aircraft manufacturers to remain largely independent of sources outside their own country. Whether deliberate and rapid, or gradual over the years, however, such development is essential.

The work these smaller companies perform is amazingly varied, as the brief directory descriptions and the photographs may indicate. The list itself is by no means exhaustive: we believe, however, that it will provide a useful source of reference.

Overhaul of Canadair-built T-33 jet trainers in one of Northwest Industries' hangars at Edmonton

CANADA

ABERCORN AERO LTD., 464 St. John Street, Montreal.—Suppliers of safety equipment, pyrotechnics, aircraft steels and other components to the Services, airlines and industry.

AERO ENGINEERING, LTD., No. 13 Hanger, Municipal Airport, Edmonton, Alberta.—Maintenance, repair and overhaul of aircraft, engines and accessories for aircraft up to DC-3 class.

AERO SURVEYS, LTD., Vancouver A.M.F., B.C.—Aerial survey work contractors, affiliated with Fairchild Aerial Survey, Inc., of Los Angeles.

AEROMAGNETIC SURVEYS, LTD., 1450 O'Connor Drive, Toronto.—See p. 310.

AEROMOTIVE ENGINEERING PRODUCTS, 5257 Queen Mary Road, Montreal 29.—Temperature controls, thermal switches and fire detectors, miniature switches, motors, generators, cold-weather engine aids, thermal controls for guided-missile hydraulic systems.

AEROQUIP (CANADA), LTD., Toronto 15.—Subsidiary of Aeroquip Corp., U.S.A.; flexible hose, couplings, etc.

AIRCRAFT APPLIANCES AND EQUIPMENT, LTD., 71 Kipling Avenue, Toronto.—Distributors and overhaul contractors for Jack and Heintz rotomotive equipment; distributors for Hartman Electrical Manufacturing relays; and for Potter (Chicago) condensers and filters. Manufacturers of electrical test equipment. Repair and overhaul contractors for the R.C.A.F.

AIRCRAFT INDUSTRIES OF CANADA, LTD., P.O. Box 200, St. John's, Quebec.—Repair, overhaul and conversion of Canso, Harvard and Dakota aircraft; repair and overhaul contracts for Department of National Defence; overhauls and conversions on executive and commercial aircraft. Plant facilities cover 85,000 sq ft; personnel employed number over 300.

ALLIED ENTERPRISES, LTD., 279 Prince Street, Montreal.—Aircraft sub-assemblies, sheet-metal work, manufacture of tools, jigs, machine parts.

ALLOY METAL SALES, LTD., 181 Fleet Street East, Toronto.—Sale and distribution of nickel and nickel alloys, stainless steels and aluminium, together with miscellaneous fittings in these materials.

ALUMINIUM COMPANY OF CANADA, LTD., 1700 Sun Life Building, Montreal, Quebec.—See p. 307.

ALUMINIUM FOUNDRY AND PATTERN WORKS, LTD., 1345 Miron St., Ville St. Laurent, Montreal, 9.—Aluminium and bronze founders, about 60 per cent of whose current production in a 20,000 sq ft plant is for the aircraft industry.

ALUMINIUM LABORATORIES, LTD.—See Aluminium *Co.*, of Canada, Ltd., p. 307.

AMERICAN CHEMICAL PAINT CO., 2224 Fleet Rd., Windsor, Ontario.—Subsidiary of the American firm, specializing in surface-treatment chemicals. Processes include "alodine" protective coating for light alloys.

ARO EQUIPMENT OF CANADA, LTD., Kipling Av., at Rexdale Blvd., Box 515, Toronto 15.—Canadian representatives of the Aro Equipment Corporation of Bryan, Ohio. Aircraft oxygen components and accessories.

ATLAS STEELS, LTD., Welland, Ontario.—Plant of 1,200,000 sq ft

COMMONWEALTH DIRECTORY . . .

is devoted to the production of special steels, including high-speed, hot-work, carbon and alloy tool, die blocks, stainless and aircraft quality to ANQQS, BSS and other specifications. Suppliers of aircraft steels to the principal airframe, engine and component manufacturers in Canada.

AVIATION ELECTRIC, LTD., 200 Laurentian Boulevard, Montreal 9, Quebec.—See p. 307.

AVIATION DEVELOPMENTS (CANADA), LTD., 2709 Yonge Street, Toronto 12.—Founded in 1941, as an extension to their then parent company, Aviation Developments, Ltd., England, in association with T. B. Martin of Toronto, the firm specializes in sales and service of specialized types of fastenings and equipment.

AVIONIC DEVELOPMENTS REG'D., 537 Keel Street, Toronto, 9.—Successors to W. P. Dunphy Co. Design consultants for aircraft, components, modifications and repair schemes. Inspection and certification of aircraft and components.

AVIQUIPO OF CANADA, LTD., 636 St. Paul Street W., Montreal.—Canadian branch of the New York Aviquipo organization; suppliers of aircraft hardware, electrical equipment, flight and engine instruments and materials.

AVRO AIRCRAFT, LTD., P.O. Box 4004, Terminal A, Toronto.—See p. 299.

BABB CO. (CANADA), LTD., P.O. Box 123, St. John's, P.Q.—Suppliers of parts for Harvard, Canso, Grumman, Beechcraft and Lodestar aircraft, and for R-985 and R-1830 engines. Manufacturing rights held for Canso PBY-5A aircraft. Associate of Babb Co., Inc., U.S.A.

BANCROFT INDUSTRIES, LTD., P.O. Box 68, Place d'Armes, Montreal.—Sales and service of aircraft hardware, engine and flight instruments. Instrument overhaul shop established in Montreal last year.

THE WALLACE BARNES CO., LTD., Hamilton, Ontario.—Springs and small stampings for aircraft engines, fuel pumps, and aircraft assemblies.

BATA ENGINEERING, Batawa, Ont.—Manufacture of components for CF-100 undercarriage, CS2F-1 undercarriage and airframe.

B.B. CHEMICAL COMPANY OF CANADA, LTD., Box 1447, Place d'Armes, Montreal.—Manufacturers of industrial adhesives for aircraft use.

G. S. BLAKESLEE AND CO., LTD., 18 Cranfield Road, Toronto 16.—Solvent vapour degreasers for aircraft-component production and overhaul processes.

BRISTOL AERO ENGINES, LTD., 10210 Pie IX Boulevard, Montreal North 12, Quebec.—See p. 301.

BRISTOL AERO ENGINES (WESTERN) LTD., Vancouver A.M.F., B.C.—See p. 301.

BRISTOL AEROPLANE COMPANY OF CANADA, LTD., 223 International Aviation Bldg., Montreal 3, Quebec.—See p. 301.

BRITISH AMERICAN OIL CO., LTD., 800 Bay St., Toronto.—Suppliers of aviation gasolines and lubricants to commercial operators and the R.C.A.F. Refineries at Montreal East, Clarkson, Moose Jaw, Edmonton and Calgary.

THE BRITISH GENERAL ELECTRIC CO. (CANADIAN), LTD., 1510 Drummond Street, Montreal 25.—Canadian sales organization for the G.E.C. of England.

THE BRITISH THOMSON-HOUSTON EXPORT CO., LTD., 7 Adelaide Street West, Toronto 1. Canadian representative of the well-known English specialists in electrical equipment of all kinds.

BRUNSWICK BALKE COLLENDER CO., OF CANADA, LTD., 36 Hanna Avenue, Toronto.—Manufacturers of reinforced plastics, in association with Zenith Plastics of Gardena, Calif. Radomes, antenna housings, fairings, ducts and structural parts.

BURNDY CANADA, LTD., 381 Greenwood Ave., Toronto 8.—Design and manufacture of electrical connectors.

CANADAIR, LTD., St. Laurent, Box 6087, Montreal, Quebec.—See p. 302.

CANADIAN AERO SERVICE, LTD., 348 Queen Street, Ottawa.—Associated with Spartan Air Services, this company operates a complete mapping geophysical and electronic survey service. Airborne magnetometer and scintillating counter surveys have been carried out extensively, and geophysical and geological interpretations of airborne and ground surveys have been made.

CANADIAN AVIATION ELECTRONICS, LTD., P.O. Box 630, Station 0, Ville St. Laurent, Quebec.—See p. 308.

CANADIAN CAR AND FOUNDRY CO., LTD., 621 Craig Street West, Montreal 3, (Headquarters); Fort William, Ont. (Plant).—See p. 303.

CANNON ELECTRIC CANADA, LTD., 160 Bartley Drive, Toronto 16.—Wholly owned subsidiary of Cannon Electric Co., of Los Angeles; manufacturers of electrical connectors for aircraft.

CANADIAN ELECTRIC RESISTORS, LTD., Curity Avenue, Toronto 16.—Vitreous enamel coated wire-wound resistors (power type) and rheostats; rotary regulating transformers.

CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal.—Suppliers of industrial and transport equipment, tools and materials; Plant at Sherbrooke, P.Q.

CANADA FOUNDRIES AND FORGINGS, LTD., Brockville and Welland, Ontario. Manufacturers of forgings for aircraft use.

CANADIAN FLIGHT EQUIPMENT, LTD., Cobourg, Ontario.—Manufacturers of ejection seats, civil aircraft seats and other aircraft components.

CANADIAN PRATT AND WHITNEY AIRCRAFT CO., LTD., Longueuil, Quebec.—See p. 303.

CARRUTH LABORATORIES, 2773 Dufferin Street, Toronto 10, Ontario.—Canadian sales office of Carruth Laboratories, Inc., of Dallas, Texas, manufacturers of aircraft instrument parts.

CARRIERE AND MACFEETERS, LTD., 51 Front St. E., Toronto.—Overhaul and repair of aircraft electrical accessories and telecommunications equipment. Contractors to Dept. of Defense Production and commercial aviation companies, employing 75 people and covering 15,000 sq ft plant space. Since the company's formation in 1948, production has increased by at least 50 per cent each year.

CANADIAN MARCONI COMPANY, 2442 Trenton Avenue, Montreal 16.—See p. 308.

CANADIAN STEEL IMPROVEMENT, LTD., 41 Horner Avenue, Etobicoke, Ontario.—See p. 300.

CANADIAN S.K.F. CO., LTD., Box 183, Station H, Toronto.—Manufacture of precision ball and roller bearings, as used by Rolls-Royce Canada, Orenda Engines and Canadian Pratt and Whitney.

CHATCO STEEL PRODUCTS, LTD., Louise St., Tilbury, Ontario.—The aircraft side of this organization hold a sub-contract for the complete manufacture and assembly of centre-sections and fins and rudders for the CF-100. Current plans for expansion envisage further major sub-assembly production and negotiations with British, U.S. and Canadian firms are under way. Plant covers 50,000 sq ft; 200 men are employed.

T. C. CHOWN, LTD., 1440 St. Catherine Street West, Montreal 25.—Canadian representatives of the Thermix Corp., Greenwich, Connecticut, dealing in pressure switches, float valves, aircraft seats, etc.

COLLINS RADIO COMPANY OF CANADA, LTD., 74 Sparks Street, Ottawa.—Sales and engineering office for Collins Radio Equipment. Establishment of manufacturing facility is planned.

COMPUTING DEVICES OF CANADA, LTD., 311 Richmond Road, P.O. Box 508, Ottawa. See p. 309.

COSSOR (CANADA), LTD., 301-303 Windsor Street, Halifax, N.S.—Wholly owned subsidiary of A. C. Cossor, England. Manufacture of navigation communications and radar equipment, deflection systems, special test gear; development facilities; overhaul and repair of aircraft electronics equipment. Own developments include advanced logarithmic amplifier, deflection coils and display systems.

CURTISS-REID MANUFACTURING CO., LTD., Box 365, Station 0, Montreal 9.—Manufacturers of airframe components and (at Cartierville Airport) overhaul and repair of light and medium aircraft. Current work: manufacture and assembly of two Norseman Mk Vs; repair and overhaul of C-47 and C-54 control surfaces.

DE HAVILLAND AIRCRAFT OF CANADA, LTD., Postal Station L., Toronto, Ontario.—See p. 304.

DECCA NAVIGATOR (CANADA) LTD., 272 Dalesford Road, Toronto 14.—See p. 309.

DECCA RADAR (CANADA), LTD., 272 Dalesford Road, Toronto 14.—See p. 309.

DEXION (CANADA), LTD., Box 114, Weston, Ont.—Manufacture of Dexion slotted angles, the general-purpose aid to aircraft production.

Rear fuselages for T-33s under subcontract construction by E. Roy Industries at L'Assomption, Quebec.

At St. Catharine's, Ontario, airframes and armament equipment are overhauled, and training aids are manufactured, by the Genaire Company

DOMINION FASTENERS, LTD., P.O. Box 492, Hamilton, Ontario.—Manufacturers of the range of fasteners designed by Tinnerman Products Inc., including self-retaining nuts and self-locking hose clamps.

DOMINION MAGNESIUM, LTD., 320 Bay Street, Toronto.—Producers of magnesium and magnesium-alloy ingots, billets, slabs, extrusions. Light Alloys, Ltd., are a wholly owned subsidiary (75,000 sq ft, 300 personnel) concerned with magnesium and aluminium alloy castings for aircraft.

DOWTY EQUIPMENT OF CANADA, LTD., Ajax, Ontario.—See p. 309.

DUNLOP CANADA, LTD., 870 Queen Street, East, Toronto 8.—Dunlop aviation products range from de-icing equipment to anti-gravity clothing for pilots in addition to the well known range of tyres, brakes and associated equipment. New plant being established at Whitby, Ontario; recently established at Toronto is the Dunlop North American Research Centre.

DUPLATE CANADA, LTD., 50 St. Clair Avenue West, Toronto.—Laminated and toughened safety glass; plants at Oshawa and Windsor, Ont.

ELECTRO - HYDRAULICS (CANADA), LTD., P.O. Box 14, Station D, Toronto. — Canadian representatives of the Electro-Hydraulics company of Warrington, England. Landing gear, hydraulic systems, electro-hydraulics and powered flight controls.

ELECTRONIC LABORATORIES OF CANADA, LTD., 281 North Howard Avenue, Vancouver. — Design and development of electronic equipment, and of loop antennae; repair and overhaul of aircraft communications equipment and of air and ground radar equipment. Manufacture of plastic components.

ELLIOTT BROTHERS, P.O. Box 124, Sioux Lookout, Ontario.—Manufacturers of aircraft ski equipment.

ENAMEL AND HEATING PRODUCTS, LTD., Aircraft Division, Amherst, Nova Scotia.—Manufacturers of major airframe assemblies. Subcontractors to de Havilland for complete tail assemblies of Grumman CS2F-1.

ENTERPRISE AGENCIES, LTD., 5301 Western Av., Montreal 28.—Agents for Eastern Industries, Inc., of Hamden, Conn., manufacturers of pressurization, dehydration and airborne cooling units; aircraft pumps; electronic-valve cooling units.

FAIREY AVIATION COMPANY OF CANADA, LTD., P.O. Box 69, Dartmouth, N.S.—See p. 305.

FEDERAL CINE-PHOTO PRODUCTS, LTD., 134 Queen St., Ottawa. Sole Canadian agents for Cinematograph Export, Ltd., of London, England, who are distributors for Vinten flight-test cinematograph equipment.

FERRANTI ELECTRIC, LTD., Mt. Dennis, Toronto 15.—Manufacturers of transformers.

FIBERGLAS CANADA, LTD., 50 St. Clair Av., W., Toronto.—Manufacturers of Fiberglas products, insulation, sleevings, cloths, moulded parts and reinforcing materials. Plants at Sarnia and Guelph, Ontario.

FIELD AVIATION COMPANY, LTD., Municipal Airport, Oshawa, Ontario.—See p. 310.

FLEET MANUFACTURING, LTD., Gilmore Road, Fort Erie, Ontario.—See p. 305.

FOUND BROS. AVIATION CO., LTD., Malton Airport, Toronto, Ontario.—Manufacturers of temperature bulbs and aircraft ground-handling equipment. Supply of reconditioned aircraft parts.

GARRETT MANUFACTURING CORP. OF CANADA, LTD., Box 513, Western P.O., Toronto 15.—Formerly Aero Sales Engineering, Ltd., now wholly owned subsidiary of the Garrett Corporation of Los Angeles, Calif. Sales and engineering representatives for AiResearch and Air Cruisers Co., (both divisions of the Garrett Corporation) and other companies. Repair and overhaul of AiResearch equipment.

GENAIRE, LTD., Municipal Airport, St. Catharine's, Ontario.—In its St. Catharine's plant of 30,000 sq ft floor area, 100 men are employed on repair and overhaul of airframe and armament equipment, and the manufacture and overhaul of training aids. Contracts include repair and overhaul of airframe components for R.C.A.F. An additional 48,000 sq ft hangar at Malton Airport, Toronto, has recently been leased, and now provides hangarage, supplies and maintenance for executive operators and itinerant aircraft.

GODFREY ENGINEERING CO., LTD., 480 Metropolitan Blvd., Lachine, Montreal 32, Quebec.—See p. 309.

B. F. GOODRICH CANADA, LTD., 251 King St., W., Kitchener, Ont.—Subsidiary of B. F. Goodrich Company of U.S.A., manufacturers of aircraft tyres, de-icers, etc.

GOODYEAR TIRE AND RUBBER CO., OF CANADA, LTD., New Toronto, Ontario.—Founded in 1910 as subsidiary of the parent organization of Akron, Ohio, the company are principally manufacturers of tyres, tubes, wheels, brakes, de-icing systems and hosing. Head office and factory at New Toronto; factories at Bowmanville, Ont., St. Hyacinthe, P.Q., and Quebec City.

HAYES STEEL PRODUCTS, LTD., Merritton, Ontario.—Manufacture of steel and aluminium alloy forgings for landing gear and other components; machining of aircraft parts.

HEROUX MACHINE PARTS, LTD., 340 Thurber, Longueuil, Quebec.—Manufacturers of hydraulic assemblies, extruded hinges and miscellaneous aircraft parts. Overhaul of hydraulic equipment is also undertaken. Pioneered special machines for aircraft-hinge production. Plant of 20,000 sq ft.

HUNTING ASSOCIATES, LTD., 1450 O'Connor Drive, Toronto.—See p. 310.

IMPERIAL OIL, LTD., 56 Church St., Toronto 1.—Suppliers of aviation gasolines, jet fuels, lubricants, greases and special products. Continuous service to Canadian aviation since the Dominion's first official air mail test flight, from Toronto to Ottawa, in 1918.

INAERCO, LTD., Box 750, Perth, Ontario.—Manufacture of high and low pressure hose and accessories, engine and airframe parts and other high-precision components.

INDUSTRIAL ELECTRONICS OF CANADA, LTD., 83 Torbarrie Road, Toronto 15.—Canadian subsidiary of the American firm of Servomechanisms, Inc., the company are principally concerned, in the aircraft field, with development of electronic fire-control equipment for Canadian fighter aircraft. Achievements include design, development and production of range servo and master air data computor. Other products: position servos, electronic components and ground power-supply rectifying equipment.

INSTRUMENTS (1951), LTD., Box 236, Ottawa.—Overhaul of flight and navigation instruments for R.C.A.F.; design and manufacture of dead-reckoning navigational equipment for R.C.A.F. and air survey companies.

INTERNATIONAL NICKEL CO., OF CANADA, LTD., 25 King Street, W., Toronto.—See p. 311.

IRVIN AIR CHUTE LTD., 479 Central Avenue, Fort Erie, Ontario. —Manufacturers of parachutes, drogues, air stabilisers and pressure-breathing flying suits. Current products include troop-training parachutes and pneumatic anti-"g" suits.

IRVINGTON VARNISH AND INSULATOR CO., OF CANADA, LTD., 1390 Burlington St., E., Hamilton, Ontario.—Subsidiary of Minnesota Mining and Mfg., of St. Paul, Minn. Manufacturers of flexible insulating materials, insulating varnishes and extruded plastic tubing.

JARRY HYDRAULICS, 4384 St. Denis Street, Montreal 18, Quebec. —See p. 311.

KENTING AVIATION, LTD., 1450 O'Connor Drive, Toronto, and Municipal Airport, Oshawa.—See p. 310.

WALTER KIDDE AND CO., OF CANADA, LTD., 6975 Jeanne Mance St., Montreal.—Manufacturers of fire extinguishing installa-

COMMONWEALTH DIRECTORY . . .

tions for aircraft, airports and test cells; pneumatic actuation equipment, oxygen equipment, aircraft compressors and auxiliary power units and other equipment. Associate of Walter Kidde company of Belleville, New Jersey.

J. W. LAWRENCE RADIATORS, LTD., 607 Chatham Street, Montreal.—Servicing, repair and overhaul of oil coolers and coolant radiators for British and American engines, together with associated control valves, thermostats, etc. Contracts for work on aircraft heat-exchangers with T.C.A., R.C.A.F., and other operators. North American agents for Marston Excelsior heat-exchangers and Flexelite fuel cells, fitted to T.C.A.'s Viscounts.

LEAVENS BROS., LTD., 3220 Dufferin St., Toronto.—Distributors of aircraft hardware, parts and supplies to manufacturers and operators. Manufacturing subcontractors to de Havillands. Manufacturers of reinforced plastics. Also widespread flying activities including scheduled and charter operations, spraying, aerial photography and flying tuition; and aircraft and engine overhaul and repair.

LIGHT ALLOYS, LTD., Haley, Ontario.—Subsidiary of Dominion Magnesium, operators of Canada's largest magnesium foundry. Government financed, the foundry was built in 1952 primarily for production of Orenda components and airframe components for A. V. Roe Canada.

LIQUIDOMETER CORP., 1740 Cote Certu, Ville St., St. Laurent, Quebec.—Canadian branch of U.S.A. firm specializing in float-type and capacitor-type gauges for all fluids; liquid-level control switches; and position indicators for flaps and other movable components.

LUCAS-ROTAX, LTD., Box 115, Station H, Toronto.—See p. 311.

MACDONALD BROS. AIRCRAFT, LTD., Stevenson Field, Winnipeg.—See p. 301.

MCQUAY-NORRIS MFG., OF CANADA, LTD., Ray and Goddard Aves., Toronto 15.—Manufacturers of components for Orenda, Nene and other engines; also electronic solenoids and control components.

MINNEAPOLIS - HONEYWELL REGULATOR CO., LTD., Leaside, Toronto 17.—Canadian factory of well-known American manufacturers of aircraft automatic control devices, whose claim it is to have produced more auto-pilots than any firm in the world, and to have developed the world's first electronic autopilot. Other products include gyros; automatic bombing systems; jet engine controls; and many types of precision instruments. Expansion of Canadian design, engineering and production facilities is planned. Total M-H. aviation facilities cover 600,000 sq ft and employ 5,000 people.

NOORDUYN NORSEMAN AIRCRAFT, LTD., P.O. Box 5, Montreal.—See p. 311.

NORMALAIR (CANADA), LTD., 922 King Street West, Toronto.—See p. 311

NORTHWEST INDUSTRIES, LTD., P.O. Box 517, Edmonton, Alberta.—See p. 311.

ORENDA ENGINES, LTD., P.O. Box 4015, Terminal A, Toronto.—See p. 300.

PANTEX MANUFACTURING (CANADA), LTD., 3556 St. Lawrence Blv., Montreal 18, Quebec.—Precision components for aircraft hydraulic systems, in particular relief valves. Subsidiary of Pantex Manufacturing Corp. of Pawtuchet, Rhode Island.

PHOENIX ENGINEERING PRODUCTS, LTD., 750 Lawrence Avenue West, Toronto 10.—Overhaul and testing of instruments, with limited manufacture of replacement parts. Special equipment maintained for testing of gyro gunsights and electronic autopilots.

THE PHOTOGRAPHIC SURVEY CORPORATION, LTD., 1450 O'Connor Drive, Toronto.—See p. 310.

PHOTOGRAPHIC SURVEYS (QUEBEC), LTD., 420 Lagauchetiere St., W., Montreal, Quebec.—See p. 311.

PRECISION RUBBER PRODUCTS (CANADA), LTD., 10 McNab St., S., Hamilton, Ontario.—Wholly Canadian subsidiary of Precision Rubber Products Corporation, Dayton, Ohio. Production of precision "O" rings and Dyns-seals for aircraft industry.

PRENCO PROGRESS AND ENGINEERING CORP., LTD., 72-74 Stafford St., Toronto.—Suppliers of flexible hose lines, Prenco-Aeroquip self-sealing couplings, hydraulic valves. Research and development on aircraft hydraulics.

P.S.C. APPLIED RESEARCH, LTD., 1450 O'Connor Drive, Toronto.—See p. 310.

PYE CANADA, LTD., 60 Front St. W., Toronto.—See p. 312.

RENFREW AIRCRAFT AND ENGINEERING CO., LTD., 660 St. Catherine St., W., Montreal.—Formed in March this year to acquire the business of Cockshutt Aircraft, Renfrew A. and E. is a subsidiary of Aluminium Castings Co. of Glasgow and hence is affiliated with Burnley Aircraft Products. With 107,000 sq ft at Renfrew, Ontario, and 240 employees, the company is one of the larger manufacturers in Canada of combustion equipment, etc., for aircraft gas turbines. The firm is entering other fields of activity among which is the design and manufacture of tooling and a variety of airport fuelling equipment.

R.F.D. (CANADA), LTD., 464 St. John St., Montreal.—See p. 312.

A. V. ROE CANADA, LTD., Box 430, Terminal A, Toronto.—See p. 299.

ROLLS-ROYCE OF CANADA, LTD., P.O. Box 10, Dorval Station, Quebec.—See p. 306.

E. ROY INDUSTRIES, LTD., L'Assomption, Quebec.—Established in 1889, the company have an aircraft division making airframe and engine assemblies; current contracts include those for T-33 rear fuselage, and machined parts for Rolls-Royce Nene.

SANDERSON AIRCRAFT, LTD., Malton Airport, Toronto.—Servicing of scheduled airline aircraft at Malton, overhaul and repair of aircraft, engines and rad.o. Manufacture of Beaver components for de Havilland.

SHELL OIL COMPANY OF CANADA, LTD., P.O. Box 400, Terminal A, Toronto 1.—Forms part of Shell's global network of aviation service, with products sold at major airports across Canada, including Gander, and to 12 major international airlines which operate through the Dominion. The company supplies aviation gasolines, turbine fuels and engine oils, in addition to special aviation fluids, greases and compounds.

SIMMONDS AEROCESSORIES OF CANADA, LTD., 5800 Monkland Avenue, Montreal 28, Quebec. See p. 312.

SMITH AND STONE, LTD., 50 St. Clair Ave., W., Toronto.—Electrical wiring devices; compression - moulded, injection - moulded, extruded and fabricated plastic components; low-pressure laminated, aluminized and silicone parts. Plant at Georgetown, Ont.

SNAP-ON TOOLS OF CANADA, LTD., 41 Cranfield Road, Toronto, are specialists in mechanics' handtools.

SPARTAN AIR SERVICES, LTD., 74 Sparks Street, Ottawa.—Specialists in aerial surveying, high-altitude photography, and magnetometer surveys, using helicopters in addition to fixed wing aircraft.

SPERRY GYROSCOPE COMPANY OF CANADA, LTD., 6011 Cote de Liesse Road, Montreal.—See p. 312.

STANDARD AERO ENGINE, LTD., Stevenson Airport, P.O. Box 764, Winnipeg.—Overhaul of aircraft engines and accessories for the R.C.A.F.; western distributors of Continental, Franklin, Lycoming and Jacobs engine parts, Stromberg carburettors, Bendix landing gear, Scintilla and Eclipse Pioneer parts and Champion spark plugs; distributors for United Manufacturing Co., of Hamden, Conn., and for the New York Air Brake Co., Stratopower pumps. Main base at Stevenson Field, Winnipeg; branches at Vancouver and Edmonton.

SURVEY AIRCRAFT, LTD., Vancouver A.M.F., B.C.—Affiliate of Aero Surveys, Ltd.

TECALEMIT (CANADA), LTD., Rexdale Blvd., Rexdale, Ontario.—Subsidiary of the Plymouth, Devon, Tecalemit company; manufacture and supply of specialized equipment and oil-filters.

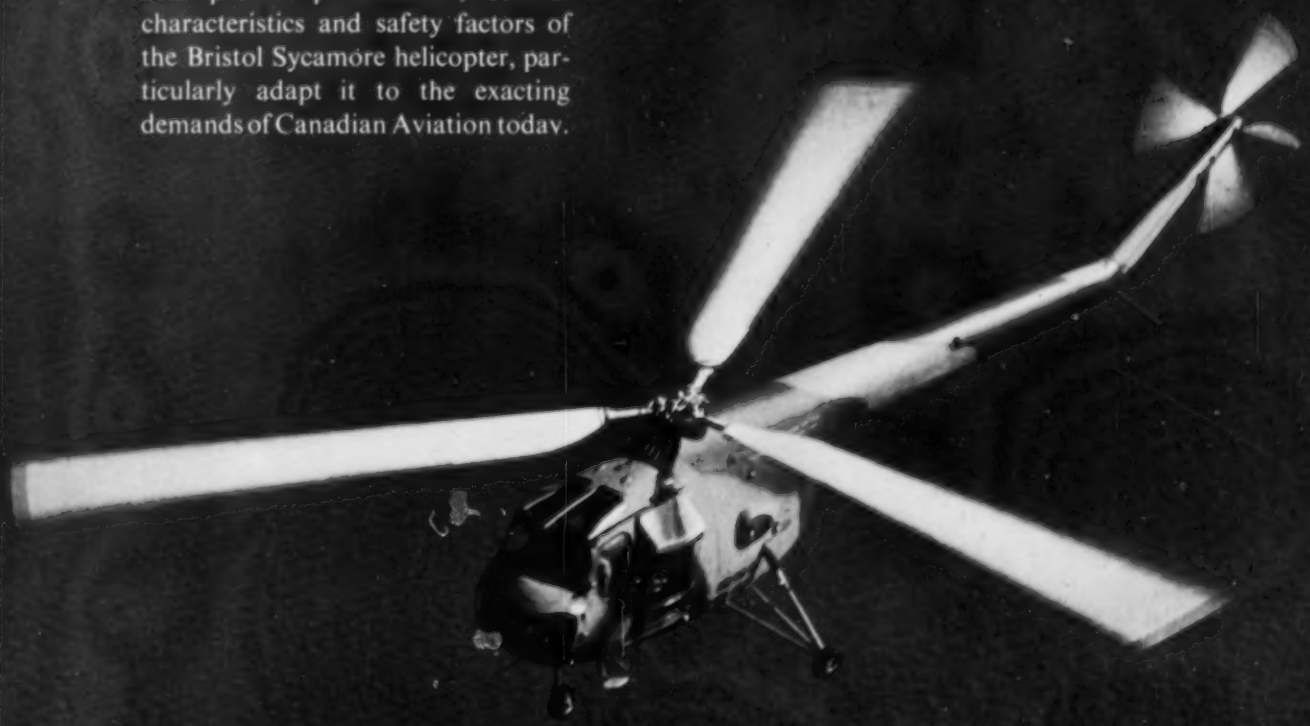
THE TIMKEN ROLLER BEARING COMPANY, 1055 Talbot Street, St. Thomas, Ontario.—Canadian manufacturing plant of the Timken Roller Bearing Company, Canton, Ohio. Canadian service and sales requirements handled through The Timken Roller Bearing Service

A Canso belonging to Quebecair being overhauled at the St. John's base of Aircraft Industries of Canada, Ltd.

SYCAMORE

POWERED BY THE ALVIS LEONIDES

The Bristol Sycamore helicopter is now in Canada, bringing with it a wealth of operating experience in Europe, Africa, Asia and Australia. The proven performance, control characteristics and safety factors of the Bristol Sycamore helicopter, particularly adapt it to the exacting demands of Canadian Aviation today.



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FUEL AND COMBUSTION SYSTEMS FOR GAS TURBINE ENGINES....

THE LUCAS-ROTAX COMPANIES OF AUSTRALIA AND CANADA are completely self-contained units fully engaged in solving problems for aircraft designers in the Australasian and American Continents. These companies bring new and exclusive facilities to all engaged in the aircraft industry.

- ✳ Manufacturing facilities of Lucas-Rotax units for every type of aircraft.
- ✳ Immediate supply and "on-the-spot" service throughout the Commonwealth to all manufacturers, operators and air forces.
- ✳ Full servicing facilities at Sydney and Montreal.
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....COMPLETE ELECTRICAL AND STARTING SYSTEMS FOR AIRCRAFT

High Energy Ignition Unit

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Aero-Commander.
Seats 5 to 7. Powered by two 270-h.p. Lycoming air-cooled, geared engines.

Beechcraft Twin-Bonanza.
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Grumman Widgeon Conversion. Seats 6. Powered by two 270-h.p. air-cooled, geared engines by Lycoming.

Safest "offices" over earth... powered by Lycoming

You are now looking at the "wings" carrying America into a great new era of safe, economical executive transportation. Each of these twin-engine, multi-passenger planes is powered by Avco's Lycoming Division . . . long a leader in the up-to-500-h.p. engine field. Each has the double dependability of *two* air-cooled Lycoming engines—so powerful that the planes can safely fly and land with a full load *on one engine alone*. Small wonder that Lycoming powers 7 out of every 10 of this year's twin-engine executive planes. In the past five years, Lycoming has powered more than 9,000 executive aircraft—both twin and single engine.

To fly any time, any place . . . these are the safest "offices" *over* earth . . . the soundest investments in executive aircraft *on* earth. *For further information, write us on your letterhead. Address Lycoming, Stratford, Conn.*

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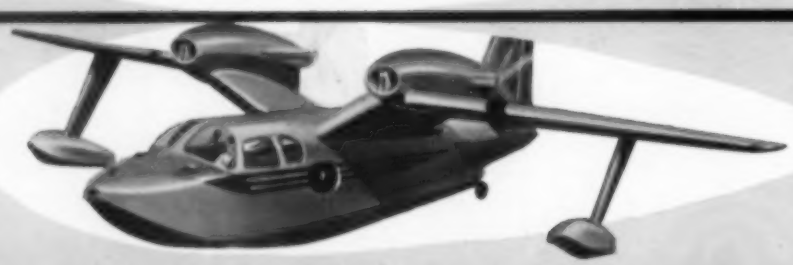
LYCOMING • AVCO ADVANCED DEVELOPMENT • CROSLEY

POWER PLANTS • ELECTRONICS • AIR-FRAME COMPONENTS • PRECISION PARTS

Piper Apache.
Seats 4. Dependably powered by two 150-h.p. air-cooled Lycoming engines.

Riley 58. Seats 4. Powered by two 170-h.p. air-cooled Lycoming engines.



Royal Gull.
Seats 5. Powered by two 270-h.p. air-cooled Lycoming engines.

and Sales Ltd., 43 Edward Street, Toronto 2, and at Vancouver and Winnipeg.

UNITED AIRCRAFT PRODUCTS (CANADA) LTD., 5257 Queen Mary Rd., Montreal.—Wholly owned Canadian subsidiary of United Aircraft Products, Inc., of Dayton, Ohio. Products include "Hi-D" liquid-to-liquid oil cooler, de-aerating cold weather oil system, hot-fuel priming pressure controls for fuel, oil and pneumatic systems.

VICTORY TOOL AND MACHINE CO., LTD., 250 Rose de Lima St., Montreal.—Manufacture of precision parts for airframes and engines.

WEATHERHEAD CO. OF CANADA, LTD., St. Thomas, Ontario.—Manufacture of hydraulic-system components (fittings, hose assemblies and couplings).

WILLIAMSON CO. OF CANADA, LTD., Postal Station L, Toronto.—Sales and service agents for aerial survey, reconnaissance and gun cameras and other photogrammetric equipment produced by the Williamson Manufacturing Co. of England. Manufacturers of the Jackson stereoscopic projector, designed primarily for R.C.A.F. operation. Offices and workshop are at Downsview, Toronto.

YORK GEARS, LTD., 825 Caledonia Rd., Toronto 10.—Subsidiary of Russell Industries, Ltd.; manufacturers of sub-assemblies and precision parts, include power take-off systems for the Orenda engine, also extensive production of a wide range of precision gears. Canadian licences for the Difusion Alloys, Ltd., process of Chromalloying for heat-, corrosion-, and abrasion-resistance.

Overhaul and calibration of Sperry instruments by the National Instrument Company of Melbourne, a subsidiary of Australian National Airways.

AUSTRALIA

G. ADAMS AND SON, 140 Gardeners Rd., Mascot, N.S.W.—Aircraft components; manufacture and repair of wooden airscrews.

W. O. AND B. ADAMS, 144 Pelham St., Carlton, Victoria.—Manufacturers of cast phosphor-bronze bar for the aircraft industry.

ADASTRA AIRWAYS PTY., LTD., 41-43 Vickers Avenue, Mascot, N.S.W.—Specialists in aerial photography and photogrammetry; air survey contractors to Federal and State governments; photography and contour mapping performed in Australia, New Guinea and Papua. Base and photographic laboratory at Kingsford Smith Airport, Mascot, Sydney.

ADASTRA - HUNTING GEOPHYSICS PTY., LTD., 41-43 Vickers Avenue, Mascot, N.S.W.—Associate company to Adastra Airways, operating on geophysics air survey work, using airborne magnetometer and scintillometer for oil and minerals exploration.

AERIAL AGRICULTURE PTY., LTD., Bankstown Airport, N.S.W.—Airframe and component repairs and overhauls; distributors of spares.

AERO SERVICE PTY., LTD., Maylands Airfield, W.A.—Manufacturers of metal and wooden aircraft components; overhaul and repair of airframes, engines and components; electrical installation and overhaul.

AERONAUTICAL SUPPLY CO. PTY., LTD., 210 Victoria Street, Melbourne, Victoria.—Manufacturers of aircraft mechanical assemblies, machined parts, sheet-metal components, etc.; distributors of spares.

AMALGAMATED WIRELESS (AUSTRALASIA) LTD., 47 York Street, Sydney, N.S.W.—See p. 327.

N. V. APPLETON PTY., LTD., Hendra, Queensland.—Manufacture and repair of plastic components.

ASSOCIATED POWER SEALS PTY., LTD., 200 Bay Street, Port Melbourne, Victoria.—Specialists in gaskets, oil seals, etc., for the aircraft industry.

AUSTRAL BRONZE CO. PTY., LTD., O'Riordan Street, Alexandria, N.S.W., and Williamson Road, Maribyrnong, Victoria, are manufacturers of aluminium bronze, bronze bars, sheet copper, and extrusions in these materials.

AUSTRALIAN ALUMINIUM CO. PTY., LTD., P.O. Box 12, Granville, N.S.W. — Producers of aluminium and its alloys in many forms, e.g. ingots, forgings, rod, bar, extruded sections, sheet, strip, etc.

AUSTRALIAN FORGE AND ENGINEERING, PTY., LTD., Parramatta Road, Lidcombe, N.S.W. —See p. 327.

AVIATION AND ENGINEERING SUPPLIES PTY., LTD., 134-142 Ferrars Street, South Melbourne, S.C.5, Victoria. — Suppliers and stockists of aircraft, engine and equipment spares, with total stores space of 64,000 sq ft; manufacturing division making and overhauling airframe parts. Representatives of Blackburn and General Aircraft, Handley Page, Scottish Aviation, etc.

AVIATION MANUFACTURING CO. PTY., LTD., Auburn, Victoria, are manufacturers and distributors of "B.G." sparking plugs and fittings.

BALM PAINTS PTY., LTD., P.O. Box 21, Concord, N.S.W.—One of the largest manufacturers and distributors of paint products in Australasia, the company employs 18,000 people in Australia and New Zealand. Current aircraft products include the complete finishing processes for the Jindivik pilotless aircraft.

BENDIX-TECNICO PTY., LTD., 53 Carrington Road, Marrickville, N.S.W.—Manufacturers of generators, regulating equipment and other electrical components for the Australian aircraft industry. Agents for Teddington controls, B.T.-H., Bendix, Champion plugs and Exide batteries. New factory at Rockdale, of 40,000 sq ft area, due for occupation this October.

BRICO (AUSTRALIA) PTY., LTD., 47 Mallett Street, Camperdown, N.S.W.—Production of engine components including aircraft piston rings. New foundry in operation for production of specialized castings.

THE BRISTOL AEROPLANE CO. (AUSTRALIA) PTY., LTD., Bankstown Airport.—See p. 327.

BRITISH AUSTRALIAN LEAD MANUFACTURERS PTY., LTD., Cabarita Road, Concord, N.S.W.—Manufacturers of aircraft finishes.

BRITISH TUBE MILLS (AUSTRALIA) PTY., LTD., Churchill Road, Kilburn, S.A.—Manufacturers of aircraft steel tubing, tubular components, gas cylinders, etc.; repair and overhaul of tubular structures.

BRUNTSONS BRIGHT STEEL PTY., LTD., Booker Street, Spotswood, Victoria.—Steel bar to aircraft specifications.

CABLE MAKERS AUSTRALIA PTY., LTD., Liverpool, New South Wales.—Manufacturers of all types of rubber, thermo-plastic and varnished cambric insulated cables, moulded rubber and plastic components; and plastic foam materials.

CASCO CHEMICALS PTY., LTD., Wellington Road, South Granville, N.S.W. — Manufacturers of glues, synthetic resins and other adhesives for aircraft and general purposes.

CHRYSLER (AUSTRALIA) LTD., Keswick, South Australia. —Manufacture of Canberra detailed parts and components, Jindivik components and Winjeel fuselage items, under sub-contract to the Government aircraft factories.

COMMONWEALTH STEEL CO., LTD., Waratah, N.S.W.—Manufacturers of steel to aircraft specifications.

G. E. CRANE AND SONS, PTY., LTD., 33 Pitt Street, Sydney, N.S.W. — Manufacturers of sheet aluminium and alloys.

DOWTY EQUIPMENT (AUSTRALIA) PTY., LTD., Bankstown, Sydney, N.S.W.—See p. 327.

DUNLOP RUBBER AUSTRALIA, LTD., 108 Flinders Street, Melbourne, Victoria.—Aviation division located at Bayswater, Victoria, producing tyres and tubes for military and civil aircraft. Present products include wheels and brakes for Canberra and Winjeel and pneumatic equipment for Jindivik and missile products. Flexible pipes and tanks produced for various aircraft engines.

EXIDE BATTERIES OF AUSTRALIA, LTD., 44 Bridge Street, Sydney, N.S.W.—Supply of Exide aircraft batteries; provision of battery parts; overhaul and repair.

FAIREY AVIATION COMPANY OF AUSTRALASIA PTY., LTD., Bankstown, N.S.W.—See p. 327.

FAWCETT AVIATION PTY., LTD., Bankstown Airport, N.S.W. —Airframe and engine overhaul and repair; overhaul of components; electrical installations and overhauls; manufacture of machined parts.

FIBRAK (AUSTRALIA) PTY., LTD., Sydney, N.S.W.—Subsidiary of Oldham and Sons, Ltd., of Manchester; battery manufacturers.

SIR GEORGE GODFREY AND PARTNERS (AUSTRALIA) PTY., LTD., 539 Bourke Street, Melbourne C.1. — Subsidiary company of the English Godfrey organization, responsible for sales, servicing, maintenance and testing of the parent firm's cabin pressure, air-conditioning and refrigeration equipment.

GOODYEAR TYRE AND RUBBER CO. (AUSTRALIA) LTD., Granville, N.S.W. — See p. 328.

HAWKER SIDDELEY GROUP, 241 Williams Street, Melbourne, C.1.—Office of the group representing all member firms.

HENDERSONS FEDERAL SPRING WORKS PTY., LTD., Alfred Street, North Melbourne, Victoria.—As part of its general production, this company supplies a wide variety of springs, plates and other small parts for aircraft.

COMMONWEALTH DIRECTORY . . .

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., 205-207 William Street, Melbourne, Victoria.—Suppliers of aircraft electrical cable.

C. HUPPERT AND CO., LTD., 193 Bouverie Street, Carlton, Victoria.—Manufacturers of aircraft fuel, hydraulic and other pumps and associated equipment; manufacturers, under licence, of Pesco pumps; manufacturers of steel and light-alloy castings, and sub-assemblies.

IMPERIAL CHEMICAL INDUSTRIES OF AUSTRALIA AND NEW ZEALAND, LTD., 376 Collins Street, Melbourne. — See p. 328.

KEEFER BROS. PTY., LTD., Martin Street, Beaumaris, Victoria.—Makers of machined parts and sheet-metal pressings.

KINGSFORD SMITH AVIATION SERVICE PTY., LTD., P.O. Box 11, Bankstown, N.S.W.—Overhaul, repair and test of aircraft, engines and instruments; manufacture of aircraft parts; also operation of flying training school.

LEWIS BERGER AND SONS (AUSTRALIA) PTY., LTD., Rhodes, Sydney, N.S.W.—Associates of the English Berger company, manufacturers of aircraft dopes and finishes.

LIGHT AIRCRAFT PTY., LTD., 14 City Road, Sydney, N.S.W.—Parachute manufacture, flare droppers, and representatives of Irving Air Chute, Martin-Baker Aircraft, G. Q. Parachute Co., Mills Equipment, Aerolex and Harley.

LUCAS-ROTAX (AUSTRALIA) PTY., LTD., 81 Bouverie Street, Melbourne, Victoria.—See p. 328.

MACROBERTSON MILLER AVIATION CO., LTD., Yorkshire House, 194 St. Georges Terrace, Perth, W.A.—Manufacturers of aircraft components; overhaul, repair and maintenance of airframes, engines and airscrews; repair and distribution of fuel pumps, instruments and other accessories.

METAL MANUFACTURERS, LTD., Port Kembla, N.S.W.—Copper and aluminium tubes, copper wires and conductors and aluminium conductors.

NATIONAL INSTRUMENT COMPANY PTY., LTD., Melbourne Airport, Essendon, Victoria.—See p. 328.

NETTLEFOLDS PTY., LTD., Ballarat Road, Sunshine, Victoria.—Manufacturers of aircraft rivets, screws, split pins, nuts (including "Aerotight" nuts), etc.

NORMALAIR (AUSTRALIA) PTY., LTD., 70 Cape Street, Heidelberg, Victoria.—See p. 328.

OLYMPIC CABLES, LTD., North Footscray, Victoria. — Approved manufacturers of electric cables and polyvinyl chloride tubing.

OLYMPIC TYRE AND RUBBER CO., LTD., West Footscray, Victoria.—Approved manufacturers of aircraft tyres and tubes.

PAUL AND GRAY PTY., LTD., Merchandise Division, 82-84 Sussex Street, Sydney.—Suppliers of aircraft components, accessories, standard parts, raw materials, engineering supplies and equipment.

PILKINGTON BROS. (AUSTRALIA), LTD., Melbourne Road, Geelong.—Makers of safety and armourplate glass.

ROLLS-ROYCE OF AUSTRALIA PTY., LTD., 66 Elizabeth Street, Melbourne.—See p. 329.

RUBBERTEX (AUSTRALIA) PTY., LTD., 547, 9 Ballarat Road, Sunshine W.20, Melbourne.—Manufacture of moulded, extruded and bonded aircraft parts to any specification, including silicone rubber. Factory facilities, which were doubled over the last year, include approved laboratory test-house.

RUSSELL MFG. CO. PTY., LTD., 81 Burnley Street, Richmond, Victoria.—Makers of piston rings and other parts for the aircraft industry.

SCHUTT AIRCRAFT SALES AND SERVICE, Moorabbin Airport, Cheltenham, Victoria.—Overhaul and repair of airframes, engines, airscrews, etc.

SHELL COMPANY OF AUSTRALIA, LTD., 163 William Street, Melbourne.—See p. 329.

SIMMONDS AEROCESSORIES (PTY.), LTD., 357 Exhibition Street, Melbourne.—Manufacturers and distributors of a wide range of aircraft accessories.

S. SMITH AND SONS (AUSTRALIA), PTY., LTD., 47 York Street, Sydney, N.S.W.—See p. 329.

SPARTAN PAINTS PTY., LTD., Melbourne, Sydney, Perth, Tasmania, etc.—Distributors of aircraft dopes and finishes; manufacturers of thinners, solvents, etc.

TECALEMIT (AUSTRALIA) PTY., Finsbury, South Australia.—Range of grease-guns, grease-nipples and greasing and tyre-inflation equipment, together with "Philidas" nuts and "Titeflex" metallic tubing.

VACUUM OIL CO. PTY., LTD., 29 Market Street, Melbourne.—See p. 329.

V.I.A., LTD., Lancefield Road, North Essendon, W.6, Melbourne.—Production of airframe components in wood and metal, under government contracts.

VOKES AUSTRALIA PTY., LTD., P.O. Box 15, Rockdale, N.S.W.—Manufacturers of all types of air, fuel, lubricating and hydraulic oil filters.

A. WASSILIEFF PTY., LTD., 434 Clarendon Street, South Melbourne, Victoria.—Manufacturers of bearings.

EDWIN WOOD PTY., LTD., 15 Equitable Place, Melbourne.—Aircraft components, accessories and tools.

Subcontract items for the Government Aircraft Factory by Chrysler (Australia) include Winjeel, Jindivik and Canberra components. Canberra drop-tanks are here seen in production at Finsbury, South Australia.

NEW ZEALAND

AIR AND MERCANTILE, LTD., Box 300, Wellington. — Agents for Armstrong Siddeley, A. V. Roe, etc.

AIR CONTRACTS, LTD., P.O. Box 209, Masterton.—Aeronautical engineers, based at Hood Aerodrome, Masterton.

AIR AND GENERAL INSTRUMENTS, LTD., P.O. Box 702, Palmerston North.—Repair and calibration of instruments.

AIRCRAFT ENGINEERING COMPANY OF N.Z., LTD., Rongotai Airport, Wellington. — Designers and contractors of light hangars and hoppers for aerial fertilizing aircraft.

AIRCRAFT SERVICE (N.Z.), LTD., P.O. Box 7, Onehunga, Auckland.—General aeronautical engineers.

AIREPAIR, P.O. Box 287, Hastings.—Overhaul, modification, repair and maintenance of light aircraft and engines at Bridge Pah Aerodrome.

AIRWORK (N.Z.), LTD., Harewood Airport, Christchurch.—Aeronautical engineers, component suppliers, repair and overhaul of light and medium aircraft, engines and components.

AMALGAMATED WIRELESS (AUSTRALASIA), LTD., P.O. Box 830, Wellington.—See p. 327.

THE BRISTOL AEROPLANE COMPANY (NEW ZEALAND), LTD., Box 547, Wellington.—Sales representatives and subsidiary of the Bristol Aeroplane Company, England.

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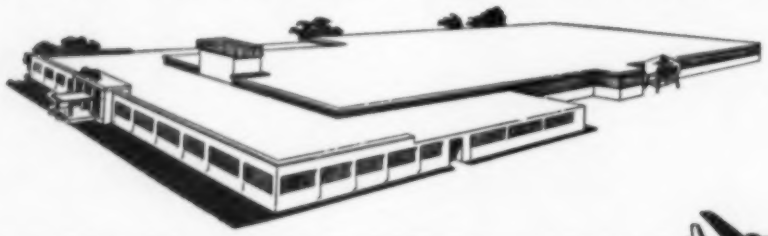

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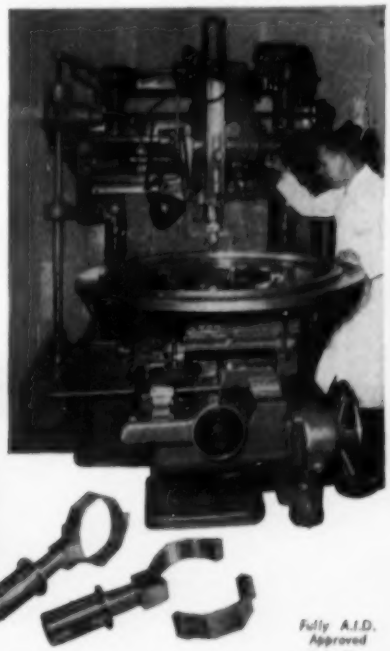

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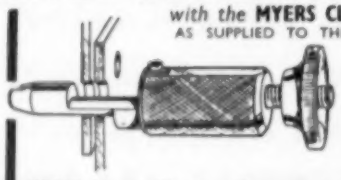

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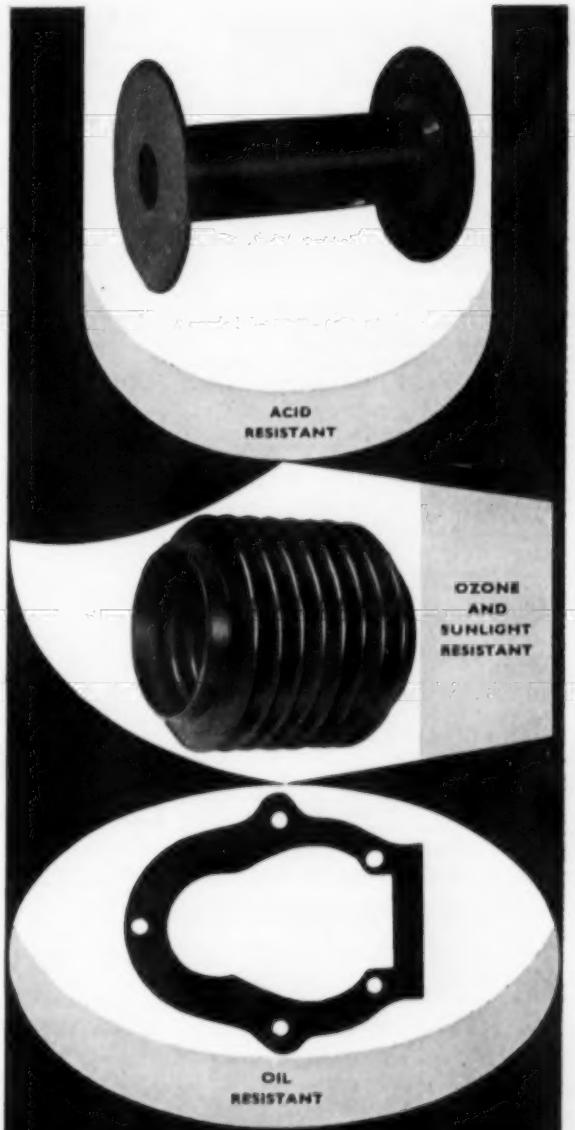

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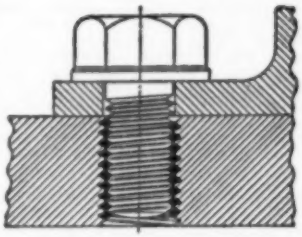

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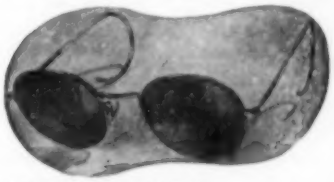

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APPLICANTS should be at least 26 years of age and possess minimum qualifications of Higher National Certificate in Electrical Engineering or Higher School Certificate in science subjects, or equivalent qualifications. A degree in science or electrical engineering subjects is desirable together with a knowledge of electronics. Experience of either analogue computing techniques, light electro-mechanical devices, automatic control or servo-mechanisms would be an advantage.

THE successful candidate will be appointed with the grade of experimental officer (£775-£945 p.a.) and will be required to join the Authority's contributory superannuation scheme.

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REQUESTS for application form should be sent on a post card to Establishment Officer, United Kingdom Atomic Energy Authority, A.E.R.E., Harwell, Didcot, Berks, quoting 2/103/292. [4153

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

APPLICATION No. 389/1. From Britavia, Ltd., of 1 Great Cumberland Place, London, W.1. For an amendment to the All Freight Service which they have applied to operate between London and Perth (Australia) which was advertised in "The Times," "The Aeroplane" and "Flight" on October 15th, 1954, so as to include traffic stops at Basle instead of at Geneva and at Paris instead of at Lyons and Marseilles.

APPLICATION No. 572. From Air Charter, Ltd., of 15 Great Cumberland Place, London, W.1. For a Colonial Coach Service with Avro Tudor aircraft or D.C.4 Skymaster aircraft for the carriage of passengers and supplementary freight between London (Stansted) and/or Southend and Lagos (Ikeja) with intermediate technical stops at Nice, Tripoli and Kano at an initial frequency of one service fortnightly increasing to three services weekly according to traffic demand for a period of from two to ten years commencing three months after date of approval.

APPLICATION No. 573. From Eagle Aviation, Ltd., of 29 Clarges Street, London, W.1. For a Seasonal Inclusive Tour Service with Viking aircraft in conjunction with Wenger Airtours, Ltd., for the carriage of passengers and supplementary freight between London (Blackbushe) and Valencia (Monises) at a frequency of one service fortnightly during the season from May to October inclusive each year for a period of seven years, commencing May, 1956.

FROM Air Kruise (Kent), Ltd., of 1 Great Cumberland Place, London, W.1, for the following Seasonal Inclusive Tour Services with Dakota aircraft for the carriage of passengers:—

APPLICATION No. 570 in conjunction with Raymond Cook Private Travel Guild for a service between Lydd and Basle at a frequency of 26 return flights during the season to be operated on Tuesdays and Fridays only from mid-May to September inclusive each year, for a period of seven years, commencing May, 22nd, 1956.

APPLICATION No. 571, in conjunction with The Methodist Guild Continental Holidays for a service between Lydd and Basle at a frequency of ten return flights during the season to be operated on Mondays and Fridays only from June to September inclusive each year for a period of seven years, commencing June 22nd, 1956.

APPLICATION No. 574 in conjunction with Blue Cars (Continental) Coach Cruises, Ltd., for a service between Lydd and Luxembourg (Sandweiler) at a frequency of 15 services weekly during the season from April to October inclusive each year for a period of seven years, commencing April 1st, 1956.

APPLICATION No. 578 in conjunction with Lewis A. LeRoy, Ltd., for a service between Lydd and Basle at a frequency of three services weekly during the season from April to October inclusive each year for a period of seven years, commencing April 1st, 1956.

APPLICATION No. 579 in conjunction with Red Line Continental Motorways, Ltd., for a service between Lydd and Luxembourg (Sandweiler) at a frequency of two services weekly during the season from April to October inclusive each year for a period of seven years, commencing April 1st, 1956.

APPLICATION No. 580. From Aquila Airways, Ltd., of 1 Great Cumberland Place, London, W.1. For an Inclusive Tour Service with Solent and Hythe Flying Boats in conjunction with Thos. Cook & Son, Ltd., for the carriage of passengers and supplementary freight between Southampton (Marine) and Lisbon (Cabo Ruivo) at a frequency of three services weekly during the period from January 1st, 1956, to December 31st, 1962.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [4157

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[4152

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Aircraft Division,
Filton House, Filton, Bristol.

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Write in confidence, quoting Ref. 86, to : The Personnel Manager (Technical Employment), de Havilland Propellers Limited, Hatfield, Herts. [4103

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(2) Junior Assistant to assist with test gear co-ordination. Applicants should have experience in the Guided Weapons or aircraft industry, and some Drawing Office experience would be an advantage. Keenness to get acquainted with the problems involved in the design and provision of test equipment is essential.

THESE positions offer excellent prospects, and housing assistance is available in certain instances. Application to Dept. C.P.S., 336/7 Strand, W.C.2, quoting ref no. 1137D. [4135

Q.F.I./Staff Pilot with Meteor experience required. Single accommodation available. Apply: Chief Pilot, Airwork, Ltd., R.N.A.S. St. Davids, Pembrokeshire. [4141

SERVICE Engineers required for aircraft pneumatic and electrical equipment. Please state experience and salary required in reply to Service Manager, Teddington Aircraft Controls, Limited, Cefn Coed, nr. Merthyr Tydfil, South Wales. [4139

AIRCRAFT Inspectors required for Details, Major Assemblies, Final Erection and Flight Shed Work. Good pay and prospects for suitable men. Apply stating age and particulars of experience to: Personnel Officer, Hawker Aircraft (Blackpool), Ltd., South Shore, Blackpool. [4138

AIRWORK GENERAL TRADING COMPANY LIMITED, have vacancies for Electrical Inspectors at Blackbushe Airport. A.R.B. "X" Licence desirable but not essential. Apply in person or by writing to The Chief Inspector, Airwork General Trading Company Limited, Blackbushe Airport, Camberley, Surrey. [4120

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